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ABSTRACT

Fictitious data for a hypothetical county are used to illustrate the basic terminology and methodologies which may be used in population and enrollment projections. Assignment material together with sample computer solutions are provided. The appendices include material on the following topics: (1) major elements of a community needs survey; (2) sample proposal (phase 1): development of an educational enrollment model for Johnson County; (3) sample proposal (phase II): expansion of JCCC's (Johnson County Community College) demographic planning model to accommodate enrollment studies of all school districts of Johnson County; (4) sample study for church planners; (5) sample study for hospital planners; and (6) sample community service report: historic and projected population data for Johnson County, Kansas. (Author)

DEMOGRAPHIC PLANNING WORKSHOP
(abstract)

by

Harold L. Finch[a]
Elaine L. Tatham[b]

Ficticious data for a hypothetical county are used to illustrate the basic terminology and methodologies which may be used in population and enrollment projections. Assignment material together with sample computer solutions are provided.

The appendices include material on the following topics:

- Major Elements of a Community Needs Survey
- Sample Proposal (PhaseI): Development of an Educational Enrollment Model for Johnson County
- Sample Proposal (Phase II): Expansion of JCCC's Demographic Planning Model to Accommodate Enrollment Studies of all School Districts of Johnson County
- Sample Study for Church Planners
- Sample Study for Hospital Planners
- Sample Community Service Report: Historic and Projected Population Data for Johnson County, Kansas

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JC 740 078

DEMOGRAPHIC PLANNING WORKSHOP

October 11-13, 1973

Presented by

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conducted by

Sheridan College of Applied Arts and Technolog
oakville, ontario

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I. INTRODUCTORY METHODOLOGY AND DATA

PIRATE COUNTY POPULATION
1900-1970

Year	Population
1900	16,650
1910	17,400
1920	18,000
1930	30,000
1940	39,000
1950	75,000
1960	180,000
1970	300,000

PIRATE COUNTY POPULATION
BY SUBAREA, 1960-1970

Subarea	1960	1970
A	9,000	8,500
B	28,000	52,500
C	28,300	107,000
D	42,400	58,000
E	72,300	74,000

PIRATE COUNTY COMMUNITY COLLEGE ENROLLMENT
1970-73

Grade	1970	1971	1972	1973
College Freshman	1500	2000	2500	3000
College Sophomore	1000	1200	1500	2000

Two-Point Linear Regression

$$Y = bX + c$$

Given two points (x_1,y_1) and (x_2,y_2) the equation is

$$Y = \frac{y_2-y_1}{x_2-x_1} (X - x_1) + y_1$$

Example

Using 1960 and 1970 Pirate County population

$$Y = \frac{300{,}000-180{,}000}{1970-1960} (X - 1960) + 180{,}000$$

$$Y = 12{,}000\ (X - 1960) + 180{,}000$$

If $X = 1980$, $Y = 420{,}000$

$X = 2000$, $Y = 660{,}000$

What about the population distribution within the county?

Using the subarea data, and finding projections individually,

For subarea A, 1980 population would be 8,000

2000 population would be 7,000

For subarea B, 1980 population would be 77,000

2000 population would be 126,000

For subarea C, 1980 population would be 185,700

2000 population would be 343,100

For subarea D, 1980 population would be 73,600

2000 population would be 104,800

For subarea E, 1980 population would be 75,700

2000 population would be 79,100

Adding the subarea projections would yield:

For the county, 1980 population would be 420,000

2000 population would be 660,000

However, for example, can 343,100 persons be expected in subarea C?

Land Use

Assume that for Pirate county, the expected number of dwellings/acre for land zoned R_1 (low density residential), R_2 (medium density residential), R_3 (high density residential) and Ag (Agricultural) are respectively 2.25, 6, 12 and .5 dwellings/acre. With 640 acres per square mile, there would be 1440, 3840, 7680 and 320 dwellings/square mile for R_1, R_2, R_3 and Ag. If 3.33 persons live in each dwelling unit, there would be:

4,795 people/square mile for R_1
12,787 people/square mile for R_2
25,574 people/square mile for R_3
1,066 people/square mile for Ag

PIRATE COUNTY CURRENT ZONING

Subarea	Square Miles	Zoning (in sq. miles)* R_1	R_2	R_3	Ag	Other
A	150	42	5	0	88	15
B	250	120	5	0	100	25
C	30	16	7	3	0	4
D	10	5	2	1	0	2
E	10	4	1	2	0	3
County	450	187	20	6	188	49

* R_1, is low density residential, R_2 is medium density residential, R_3 is high density residential, Ag is agriculture while "Other" includes parks, airports, industrial, commercial, etc.

ESTIMATES OF SUBAREA CAPACITIES
FOR CURRENT ZONING

Subarea	Estimated Capacity
A	
B	
C	
D	
E	
County	

Multiple-Point Linear Regression

$$Y = bX + a$$

where Y is criterion

X is predictor variable

Given n pairs of observations for X and Y,

$$b = \frac{n \sum_{i=1}^{n} X\,Y - \sum_{i=1}^{n} X \sum_{i=1}^{n} Y}{n \sum_{i=1}^{n} X^2 - (\sum_{i=1}^{n} X)^2} \quad , \; a = \overline{Y} - b\,\overline{X} = \frac{\sum_{i=1}^{n} Y}{n} - b\left(\frac{\sum_{i=1}^{n} X}{n}\right)$$

Example

Using the population data for Pirate County, 1920-1970, the criterion Y is population while the predictor variable X is year,

$$n = 6, \quad \sum_{i=1}^{6} X = 1920+1930+1940+1950+1960+1970=11670$$

$$\sum_{i=1}^{6} Y = 18000 + 30000 + 39000 + 75000 + 180000 + 300000 = 642000$$

$$\sum_{i=1}^{6} X^2 = (1920)^2+(1930)^2+(1940)^2+(1950)^2+(1960)^2+(1970)^2=22,699,900$$

$$\sum_{i=1}^{6} X\,Y = (1920)(18,000)+(1930)(30,000)+(1940)(39,000)+(1950)(75,000) +(1960)(180,000)+(1970)(300,000)=1,258,170,000$$

$$b = \frac{6(1,258,170,000)-(11670)(642,000)}{6(22,699,900)-(11670)^2} = \frac{5688}{1.05} = 5417.14$$

$$a = \frac{642,000}{6} - 5417.14\left(\frac{11670}{6}\right) = -\,10,429,337.30$$

$$Y = 5417.14(X) - 10,429,337.30$$

For X = 1980, Y = 296,600 which is less than actual 1970 population.

Two-Point Logistic Curve

S - shaped

$$P_{t_1+\theta} = \frac{K}{1+e^{a+b\theta}}$$

Where P is population

t_1 is starting year

θ is number of years past starting year

K is holding capacity

Given K and P_{t_1} for year t_1

P_{t_2} for year t_2, where $t_2 > t_1$

$$a = \ln\left(\frac{K-P_{t_1}}{P_{t_1}}\right) \qquad b = \left[\frac{\ln\left(\frac{K-P_{t_2}}{P_{t_2}}\right) - a}{t_2-t_1}\right]$$

Example

$K = 1{,}500{,}000$

$t_1 = 1960$, $P_{1960} = 180{,}000$

$t_2 = 1970$, $P_{1970} = P_{1960+10} = 300{,}000$

$$a = \ln\left(\frac{1{,}500{,}000-180{,}000}{180{,}000}\right) = \ln\left(\frac{1{,}320{,}000}{180{,}000}\right) = \ln\left(\frac{132}{18}\right)$$

$$= \ln\left(\frac{22}{3}\right) = \ln(22) - \ln(3) = 3.09104 - 1.09861 = 1.99243$$

$$b = \frac{\ln\left(\frac{1{,}500{,}000-300{,}000}{300{,}000}\right) - 1.99243}{1970-1960} = \frac{\ln\left(\frac{1{,}200{,}000}{300{,}000}\right) - 1.99243}{10}$$

$$= \frac{\ln(4) - 1.99243}{10} = \frac{1.38629-1.99243}{10} = \frac{-.60614}{10} = -.060614$$

So $P_{1960+\theta} = \dfrac{1{,}500{,}000}{1+e^{1.99243-.060614\theta}}$

Proof that a and b are obtained as specified on preceeding page for the logistic curve.

$$P_{t_1+\theta} = \frac{K}{1+e^{a+b\theta}}$$

At time t_1, $\theta = 0$, $P_{t_1} = \frac{K}{1+e^{a}}$ so $P_{t_1}(1+e^{a}) = K$

$$P_{t_1} + P_{t_1}(e^{a}) = K$$

$$P_{t_1}e^{a} = K - P_{t_1}$$

$$e^{a} = \frac{K-P_{t_1}}{P_{t_1}}$$

$$a = \ln\left(\frac{K-P_{t_1}}{P_{t_1}}\right)$$

At time t_2, $\theta = t_2-t_1$ where $t_2>t_1$

$$P_{t_2} = \frac{K}{1+e^{a+b(t_2-t_1)}}$$

$$P_{t_2}\left(1+e^{a+b(t_2-t_1)}\right) = K$$

$$P_{t_2} + P_{t_2}e^{a+b(t_2-t_1)} = K$$

$$P_{t_2}e^{a+b(t_2-t_1)} = K-P_{t_2}$$

$$e^{a+b(t_2-t_1)} = \frac{K-P_{t_2}}{P_{t_2}}$$

$$a+b(t_2-t_1) = \ln\left(\frac{K-P_{t_2}}{P_{t_2}}\right)$$

So $b(t_2-t_1)=\ln\left(\frac{K-P_{t_2}}{P_{t_2}}\right)- a$

And $b = \dfrac{\ln\left(\frac{K-P_{t_2}}{P_{t_2}}\right) - a}{t_2-t_1}$

Multiple-Point Logistic Curve

$$P_{t_1+\theta} = \frac{K}{1+e^{a+b\theta}}$$

Given year t_1, capacity K and n observations, a and b are found so that the "best fit" is found. The procedure utilizes a transformation as follows:

$$P_{t_1+\theta}(1+e^{a+b\theta}) = K$$

$$P_{t_1+\theta} + P_{t_1+\theta}e^{a+b\theta} = K$$

$$P_{t_1+\theta}e^{a+b\theta} = K - P_{t_1+\theta}$$

$$e^{a+b\theta} = (K - P_{t_1+\theta})\frac{1}{P_{t_1+\theta}}$$

$$a+b\theta = \ln\left(\frac{K-P_{t_1+\theta}}{P_{t_1+\theta}}\right)$$

Let $Z = \ln\left(\frac{K-P_{t_1+\theta}}{P_{t_1+\theta}}\right)$

Then $Z = a + b\theta$

Next find the best linear fit for $Z = a + b\theta$, where $\theta = t_2-t_1$

Example

Use the 1950, 1960 and 1970 Pirate County population data together with a capacity of 1,500,000 people and a base year t_1=1960

For 1950, $\theta = -10$, $Z = \ln\left(\frac{1,500,000-75,000}{75,000}\right) = 2.94444$

1960, $\theta = 0$, $Z = \ln\left(\frac{1,500,000-180,000}{180,000}\right) = 1.99243$

1970, $\theta = 10$, $Z = \ln\left(\frac{1,500,000-300,000}{300,000}\right) = 1.38629$

$$\sum_{i=1}^{3}\theta = -10 + 0 + 10 = 0$$

$$\sum_{i=1}^{3}Z = 2.94444 + 1.99243 + 1.38629 = 6.32316$$

$$\sum_{i=1}^{3}\theta^2 = 100 + 0 + 100 = 200$$

$$\sum_{i=1}^{3}\theta Z = (-10)(2.94444) + 0(1.99243) + 10(1.38629) = -15.5815$$

$$b = \frac{3(-15.5815) - (0)(6.32316)}{3\ (200) - (0)^2} = -.07791$$

$$a = \frac{6.32316}{3} - (-.07791)\left(\frac{0}{3}\right) = 2.10772$$

So $Z = 2.10772 - .07791\theta$

Or $P_{t_1+\theta} = \frac{K}{1+e^{2.10772-.07791\theta}}$ for $K = 1,500,000$

For 1980, $\theta = 20$

$$P_{1980} = \frac{1,500,000}{1+e^{2.10772-1.55820}} = \frac{1,500,000}{1+e^{.54952}}$$

$$= \frac{1,500,000}{1+1.7324} = \frac{1,500,000}{2.7324} = 548,968$$

ASSIGNMENT MATERIAL: LOGISTIC CURVE AND LINEAR REGRESSION

Read Introduction, Chapter 1 and p. 88-104 of The Limits to Growth.

When reading, concentrate on big picture, not details.

Do the following calculations:

1) For your subarea, develop the equation for the straight line fitting the 1960 and 1970 population data,

2) For your subarea, determine the coefficients a and b for the logistic curve assuming capacity based on current zoning,

3) Develop the equation for the straight line fitting the 1970-73 sophomore data for Pirate County Community College. Might try doing the same for the freshman since the answer can be written down by inspection.

The following problems illustrate the "what if" capability of a model*:

1) For your subarea, develop the equation for the straight line fitting the 1960 and 1970 population data. Project population for 1975-2000 by 5-year increments.

2) For your subarea, develop the equation for the logistic curve,

   a) Assuming capacity based on current zoning. Project population for 1975-2000 by 5-year increments.

   b) Assuming capacity 10% more than that used in part a. Project population for 1975-2000 by 5-year increments.

   c) Assuming capacity 10% less than that used in part a. Project population for 1975-2000 by 5-year increments.

3) Develop the linear equations for the freshman and sophomore enrollments at Pirate County Community College using the data for 1970-73. Project enrollments for 1974-1982 by 1 year increments.

* Optional problems for those desiring additional practice.

Sample Computer Programs

Program LOG2PT

Input
- Holding capacity
- Population for starting year t_1
- Starting year t_1
- Population for second year t_2 where $t_2 > t_1$
- Second year t_2

Output
- a and b for equation
- Projections for future years

Sample

```
FCR,ØLD,LØG2PT

READY.
RNH
ENTER HØLD. CAP., PØP1, YR1, PØP2, YR8
 ? 1500000,180000,1960,300000,1970
A=  1.99243016E+00    B= -6.06135804E-02
ENTER YEAR(1), YEAR(2), DELTA YEAR
 ? 1970,2000,5
    PØP(CALC)            YEAR        PERCENT
    300000               1970        .20000          111111111
    379344               1975        .25290           11111111
    471429               1980        .31429           11111111
    574409               1985        .38294            1111111
    684906               1990        .45660             111111
    798325               1995        .53222             111111
    909567               2000        .60638              11111
ENTER HØLD. CAP., PØP1, YR1, PØP2, YR2
 ? STØP
```

$$P_{1960+\theta} = \frac{1,500,000}{1+e^{1.99243-.060614\theta}}$$

Program LSRPROJ

Input
- Data File Name
- Number of Variables
- X Index
- Y Index

Output
- Means for X and Y
- Standard deviations for X and Y
- Correlation between X and Y
- Coefficients A and B for equation y= A + BX
- Observed and calculated Y
- Projections for future years

BEST COPY AVAILABLE

Available files

SUBPIR	Pirate county population 1960-1970
SUBA	Subarea A population 1960-1970
SUBB	Subarea B population 1960-1970
SUBC	Subarea C population 1960-1970
SUBD	Subarea D population 1960-1970
SUBE	Subarea E population 1960-1970
FRESH	Pirate County Community College freshman, 1970-73
SOPH	Pirate County Community College sophomore, 1970-73
PIRATE	Pirate County population, 1930-70

Sample

```
FØR,OLD,PIRATE

READY.
LNF
00100 1920, 18000
00110 1930, 30000
00120 1940, 39000
00130 1950, 75000
00140 1960,180000
00150 1970,300000


RUN COMPLETE.

FØR,ØLD,LSRPRØJ

READY.
RNH

ENTER FILE NAME, # VARIABLES, X INDEX, Y INDEX ? PIRATE,2,1,2
INPUT NØ. ØPS.
 ? 6
 MEANS =      1945.0000 107000.0000
 STD. DEVIATION =         18.7083 111493.5164
 CORRELATION COEFF. R AND R↑2 =      .90955     .88728
A=-1.04293429E+07     B= 5.41714286E+03
     Y(ØBS)            Y(CALC)          ERRØR            X(ØBS)
   18000.00000      -28488.57142      46428.57142      1920.00000
   30000.00000       25742.85715       4257.14285      1930.00000
   39000.00000       79914.28572     -40914.28572      1940.00000
   75000.00000      134085.71428     -59085.71428      1950.00000
  180000.00000      188257.14285      -8257.14285      1960.00000
  300000.00000      242428.57142      57571.42858      1970.00000
INPUT 1 FØR PRØJECTIØN
 ? 1
ENTER X1,X2 & DELTA X
 ? 1970,2000,5
    Y(CALC)          X
  242428.57142      1970.00000
  269514.28570      1975.00000
  296599.99998      1980.00000
  323685.71427      1985.00000
  350771.42855      1990.00000
  377857.14283      1995.00000
INPUT 1 FØR PRØJECTIØN
 ? STØP
```

II. COHORT SURVIVAL

SAMPLE COHORT SURVIVAL PROBLEM

PIRATE COUNTY SCHOOL ENROLLMENT
Grade 1-4, 1970-73

Grade	1970	1971	1972	1973
1	4200	4500	4600	4700
2	3700	4000	4200	4300
3	3600	3700	4000	4200
4	3700	3800	4000	4500

SURVIVAL RATES

Grade	1970-71	1971-72	1972-73	Average	Alternate Case
1-2					1.2
2-3					1.1
3-4					.9

PROJECTED ENROLLMENTS USING AVERAGE SURVIVAL RATES
1974-76

Grade	1974	1975	1976
2		*	*
3			*
4			

* Cannot be obtained from data provided.

PROJECTED ENROLLMENTS USING SAMPLE CASE SURVIVAL RATES
1974-76

Grade	1974	1975	1976
2		*	*
3			*
4			

* Cannot be obtained from data provided.

COHORT SURVIVAL PROBLEM

PIRATE COUNTY SCHOOL ENROLLMENT
Grade 5-12, 1970-73

Grade	1970	1971	1972	1973
5	4500	3500	3000	2900
6	5200	4500	3500	3000
7	5400	5300	4500	3600
8	5100	5400	5300	4600
9	5900	5200	5300	5200
10	6000	5900	5500	5200
11	5500	5400	5200	5300
12	4800	5000	5200	5000

PIRATE COUNTY COMMUNITY COLLEGE ENROLLMENT
1970-73

Grade	1970	1971	1972	1973
College Freshman	1500	2000	2500	3000
College Sophomore	1000	1200	1500	2000

SURVIVAL RATES

Grade	1970-71	1971-72	1972-73	Average	Alternate Case
5-6					1.1000
6-7					1.0159
7-8					1.0074
8-9					.9941
9-10					1.0129
10-11					.9150
11-12					.9445
12-College Freshman					.4979
College Freshman-Sophomore					.8300

PROJECTED ENROLLMENTS USING AVERAGE SURVIVAL RATES
1974-1982

Grade	1974	1975	1976	1977	1978	1979	1980	1981	1982
6		*	*	*	*	*	*	*	*
7			*	*	*	*	*	*	*
8				*	*	*	*	*	*
9					*	*	*	*	*
10						*	*	*	*
11							*	*	*
12								*	*
College Freshman									*
College Sophomore									

*Cannot be obtained from data provided.

PROJECTED ENROLLMENTS USING SAMPLE CASE SURVIVAL RATES
1974-1982

Grade	1974	1975	1976	1977	1978	1979	1980	1981	1982
6		*	*	*	*	*	*	*	*
7			*	*	*	*	*	*	*
8				*	*	*	*	*	*
9					*	*	*	*	*
10						*	*	*	*
11							*	*	*
12								*	*
College Freshman									*
College Sophomore									

*Cannot be obtained from data provided.

III. POPULATION GROWTH FOR PIRATE COUNTY

Components of Population Growth

$$P_t = P_o + (B-D) + (M_{in} - M_{out})$$

where P_o is population at starting time

P_t is population t years later

B is births during t years

D is deaths during t years

M_{in} is in-migration during the t years

M_{out} is out-migration during the t years

(B-D) is growth due to reproductive change (natural increase)

$(M_{in} - M_{out})$ is growth due to net migration

Crude birth rate - Number of children born during a specific year per 1,000 total population.

Crude death rate - Number of deaths during a specific year per 1,000 total population.

Fertility rate - Number of children born during a specific year per 1,000 women of reproductive age or any age group within the childbearing age range

BIRTH DATA BY AGE OF MOTHER FOR 1960 AND 1970
PIRATE COUNTY

Age of Mother	1960 Births	1960 Fertility Rates*	1970 Births	1970 Fertility Rates*
10-14	2		5	
15-19	183		497	
20-24	516		1634	
25-29	909		1961	
30-34	548		726	
35-39	198		232	
40-44	49		76	
45-49	1		3	
Total	4320		5134	

* Per 1000 women of that age group.

CRUDE BIRTH AND DEATH RATES AND FERTILITY RATES
FOR WOMEN AGES 15-44 FOR 1970

Subarea	Births	Crude Birth Rate	Deaths	Death Rate	Women Ages 15-44	Fertility Rate*
A	143		52			
B	960		273			
C	1927		361			
D	954		356			
E	1150		451			
County	5134		1493			

* Per 1,000 women, ages 15-44.

MIGRATION FOR DECADE 1960-1970
PIRATE COUNTY

Subarea	Births 1960	Births 1970	Average Births Per Year	Deaths 1960	Deaths 1970	Average Deaths Per Year	Population 1960	Population 1970	Births For Decade	Deaths For Decade	Net Migration For Decade
A	242										
B	817										
C	836										
D	938										
E	1487										
County	4320										

SUBAREA PERCENTAGE SHARE OF PIRATE COUNTY MIGRATION
1960-1970

Subarea	Percentage of County Migration for Decade
A	
B	
C	
D	
E	

POPULATION AND DEATH DATA FOR PIRATE COUNTY
1960

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	1966	45		1850	33	
1-4	8949	5		9275	5	
5-9	12505	7		12413	5	
10-14	10737	5		9042	3	
15-19	5443	3		4977	1	
20-24	3057	3		3390	1	
25-29	4403	0		5616	1	
30-34	6909	5		7924	5	
35-39	8824	9		8636	7	
40-44	6997	23		7112	19	
45-49	5676	21		5794	14	
50-54	4528	47		4090	25	
55-59	2907	36		2840	20	
60-64	2091	47		2594	31	
65-69	1666	49		1939	34	
70-74	1051	70		1628	60	
75-79	694	61		1042	56	
80-84	309	46		602	60	
85 +	188	44		336	66	
Total	88,900	526		91,100	446	

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA A
1960

Age Group	Males Population	Deaths	Death Rate*	Females Population	Deaths	Death Rate*
Under 1	130	3		131	2	
1-4	483	0		489	0	
5-9	472	1		420	0	
10-14	376	0		370	0	
15-19	765	1		342	0	
20-24	699	1		305	0	
25-29	405	0		304	0	
30-34	419	0		299	0	
35-39	325	1		236	0	
40-44	249	1		187	1	
45-49	147	1		136	0	
50-54	137	1		124	1	
55-59	109	1		103	1	
60-64	88	2		94	1	
65-69	108	3		110	2	
70-74	71	4		98	3	
75-79	59	6		73	5	
80-84	36	5		49	5	
85 +	21	4		30	6	
Total	5,100	35		3,900	27	

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA B
1960

Age Group	Males Population	Males Deaths	Males Death Rate*	Females Population	Females Deaths	Females Death Rate*
Under 1	407	9		425	8	
1-4	1519	1		1602	1	
5-9	1756	1		1551	1	
10-14	1402	1		1373	0	
15-19	947	0		1058	0	
20-24	862	1		952	0	
25-29	975	0		1064	1	
30-34	1011	1		1053	1	
35-39	1002	1		913	1	
40-44	763	2		730	2	
45-49	643	2		657	2	
50-54	600	7		597	3	
55-59	452	6		494	3	
60-64	373	9		444	6	
65-69	361	11		430	8	
70-74	234	15		380	14	
75-79	200	17		277	15	
80-84	123	19		190	19	
85 +	70	16		110	21	
Total	13,700	119		14,300	106	

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA C
1960

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	412	10		372	7	
1-4	1953	1		1922	1	
5-9	2287	1		2253	1	
10-14	1641	1		1486	1	
15-19	506	0		599	0	
20-24	221	0		523	0	
25-29	901	0		1192	0	
30-34	1605	1		1823	1	
35-39	1916	2		1662	1	
40-44	1045	3		824	2	
45-49	594	3		522	2	
50-54	405	4		320	2	
55-59	240	3		214	1	
60-64	154	3		196	2	
65-69	90	2		128	2	
70-74	67	5		89	4	
75-79	37	3		34	2	
80-84	15	2		26	2	
85 +	11	3		15	3	
Total	14,100	47		14,200	34	

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA D
1960

Age Group	Males			Females		
	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	280	7		355	6	
1-4	1847	1		1789	1	
5-9	2508	1		2573	1	
10-14	2243	1		1847	1	
15-19	1245	1		1278	1	
20-24	660	1		784	0	
25-29	1091	0		1221	0	
30-34	1231	1		1534	1	
35-39	1510	1		1699	2	
40-44	1584	6		1922	5	
45-49	1600	5		1732	4	
50-54	1518	15		1485	9	
55-59	1147	14		1081	8	
60-64	751	16		949	11	
65-69	627	19		619	11	
70-74	421	28		421	15	
75-79	214	19		289	12	
80-84	74	11		140	14	
85 +	49	12		82	16	
Total	20,600	159		21,800	118	

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA E
1960

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	737	16		567	10	
1-4	3147	2		3473	2	
5-9	5482	3		5616	2	
10-14	5075	2		3966	1	
15-19	1980	1		1700	0	
20-24	615	0		826	1	
25-29	1031	0		1835	0	
30-34	2643	2		3215	2	
35-39	4071	4		4126	3	
40-44	3356	11		3449	9	
45-49	2692	10		2747	6	
50-54	1868	20		1564	10	
55-59	959	12		948	7	
60-64	725	17		911	11	
65-69	479	14		652	11	
70-74	258	18		640	24	
75-79	184	16		369	22	
80-84	61	9		197	20	
85 +	37	9		99	20	
Total	35,400	166		36,900	161	

* Per thousand persons.

POPULATION AND DEATH DATA FOR PIRATE COUNTY
1970

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	2634	48		2500	27	
1-4	11026	6		10410	5	
5-9	17245	10		16414	4	
10-14	17386	4		17041	5	
15-19	13838	26		13589	4	
20-24	8024	5		10728	9	
25-29	10702	18		12099	5	
30-34	10075	10		10526	5	
35-39	9539	11		10038	8	
40-44	10122	23		10739	21	
45-49	10367	34		10228	29	
50-54	7966	59		8070	43	
55-59	6060	56		6155	35	
60-64	4523	82		4791	53	
65-69	2849	117		3349	59	
70-74	1929	88		2739	79	
75-79	1213	75		1831	89	
80-84	569	54		1298	91	
85 +	433	62		955	134	
Total	146,500	788		153,500	705	

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA A
1970

Age Group	Males			Females		
	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	73	1		60	1	
1-4	365	0		355	0	
5-9	521	0		448	0	
10-14	520	0		490	0	
15-19	389	1		382	0	
20-24	368	0		352	0	
25-29	294	1		307	0	
30-34	277	0		266	0	
35-39	233	0		225	0	
40-44	245	1		237	0	
45-49	236	1		240	1	
50-54	183	1		189	1	
55-59	168	2		136	1	
60-64	123	2		138	1	
65-69	114	5		118	2	
70-74	77	4		96	3	
75-79	62	4		73	4	
80-84	29	3		51	4	
85 +	23	3		37	5	
Total	4,300	29		4,200	23	

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA B
1970

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	492	9		468	5	
1-4	2129	1		2061	1	
5-9	3179	2		2848	1	
10-14	3054	1		3051	1	
15-19	2616	5		2649	1	
20-24	1936	1		2300	2	
25-29	2021	3		2097	1	
30-34	1902	2		1827	1	
35-39	1506	2		1508	1	
40-44	1599	4		1615	3	
45-49	1450	5		1387	4	
50-54	1115	8		1096	6	
55-59	895	8		960	5	
60-64	741	13		731	8	
65-69	484	20		586	10	
70-74	328	15		483	14	
75-79	248	15		419	20	
80-84	116	11		297	21	
85 +	89	13		217	30	
Total	25,900	138		26,600	135	

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA C
1970

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	988	18		938	10	
1-4	4145	2		3903	2	
5-9	6890	4		6518	1	
10-14	6724	1		6638	2	
15-19	4846	9		4653	1	
20-24	2329	2		3479	3	
25-29	4182	7		4932	2	
30-34	3937	4		4286	2	
35-39	4124	5		4203	3	
40-44	4373	9		4504	9	
45-49	3719	12		3305	9	
50-54	2854	21		2607	14	
55-59	1542	14		1326	8	
60-64	930	17		915	10	
65-69	503	21		630	11	
70-74	346	16		517	15	
75-79	203	13		375	18	
80-84	95	9		271	19	
85 +	70	10		200	28	
Total	52,800	194		54,200	167	

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA D
1970

Age Group	Males			Females		
	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	489	9		465	5	
1-4	1775	1		1671	1	
5-9	2747	2		2670	1	
10-14	3092	1		3017	1	
15-19	2707	5		2712	1	
20-24	1755	1		2340	2	
25-29	1787	3		1980	1	
30-34	1683	2		1727	1	
35-39	1632	2		1850	2	
40-44	1733	4		1974	4	
45-49	2244	7		2376	7	
50-54	1724	13		1872	10	
55-59	1530	14		1602	9	
60-64	1155	21		1304	15	
65-69	782	32		869	15	
70-74	527	24		708	20	
75-79	294	18		434	21	
80-84	137	13		303	21	
85 +	107	15		226	32	
Total	27,900	187		30,100	169	

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA E
1970

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	590	11		560	6	
1-4	2614	2		2429	1	
5-9	3908	2		3930	1	
10-14	3996	1		3845	1	
15-19	3280	6		3193	1	
20-24	1636	1		2257	2	
25-29	2418	4		2783	1	
30-34	2276	2		2420	1	
35-39	2044	2		2252	2	
40-44	2172	5		2409	5	
45-49	2718	9		2920	8	
50-54	2090	16		2306	12	
55-59	1925	18		2131	12	
60-64	1574	29		1703	19	
65-69	966	39		1146	21	
70-74	651	29		935	27	
75-79	406	25		530	26	
80-84	192	18		376	26	
85 +	144	21		275	39	
Total	35,600	240		38,400	211	

* Per thousand persons.

ASSIGNMENT MATERIAL: COHORT SURVIVAL AND POPULATION GROWTH

Do the following calculations.

1) Using the cohort survival model, project Pirate County Community College freshman and sophomore enrollment for 1974-1982 by 1-year increments.

   a) Assuming the average survival rates for grades 5 through college sophomore for the years 1970-73 continue through 1982.

   b) Assuming that the alternate survival rates continue for 1974-1982 due to the gradual closing of parochial schools in the county and better retention of college sophomores.

2) For your subarea, find:

   a) Crude birth and death rates.

   b) Fertility rate for women, ages 15-44.

   c) Net migration for decade 1960-70.

   d) Death rates by age groups and sex for 1970.

BEST COPY AVAILABLE

Sample Computer Program

Program PIRENR

<u>Input</u> Date File Name
Options:
1) May change average survival rates.
2) May change 1973 enrollment data.

<u>Output</u> Average survival rates by grade
Projected enrollment by grade

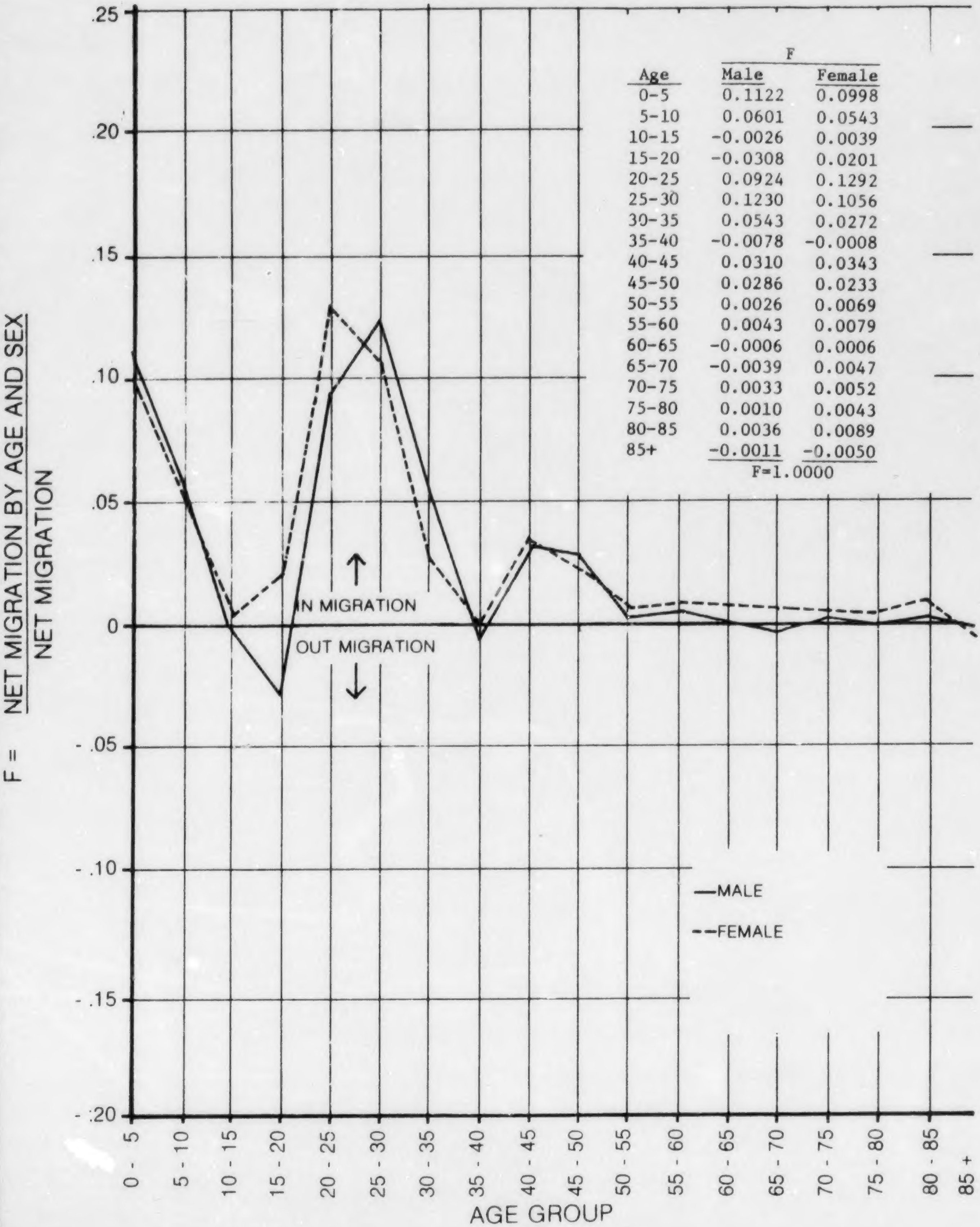
<u>Available Files</u>

ENROLL
SAMPLE

<u>Sample</u>

```
FØR,ØLD,PIRENR

READY.
RNH

ENTER FILE NAME
 ? SAMPLE
 GRADE    1970-71 1971-72 1972-73 AVERAGE
  1- 2      .9524   .9333   .9348   .9402
  2- 3     1.0000  1.0000  1.0000  1.0000
  3- 4     1.0556  1.0811  1.1250  1.0872


GRADE    RATE 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982
    1  .9402 4700    0    0    0    0    0    0    0    0    0
    2 1.0000 4300 4419    0    0    0    0    0    0    0    0
    3 1.0872 4200 4300 4419    0    0    0    0    0    0    0
    4 0.      4500 4566 4675 4804    0    0    0    0    0    0
ENTER NEW RATES (9) SEPERATED BY (,)
 ? 1.2,1.1,.9,0
ENTER 1 FØR NEW 1973 ENRØLLMENT
 ? 0


GRADE    RATE 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982
    1 1.2000 4700    0    0    0    0    0    0    0    0    0
    2 1.1000 4300 5640    0    0    0    0    0    0    0    0
    3  .9000 4200 4730 6204    0    0    0    0    0    0    0
    4 0.      4500 3780 4257 5584    0    0    0    0    0    0
ENTER NEW RATES (9) SEPERATED BY (,)
 ? STØP
```

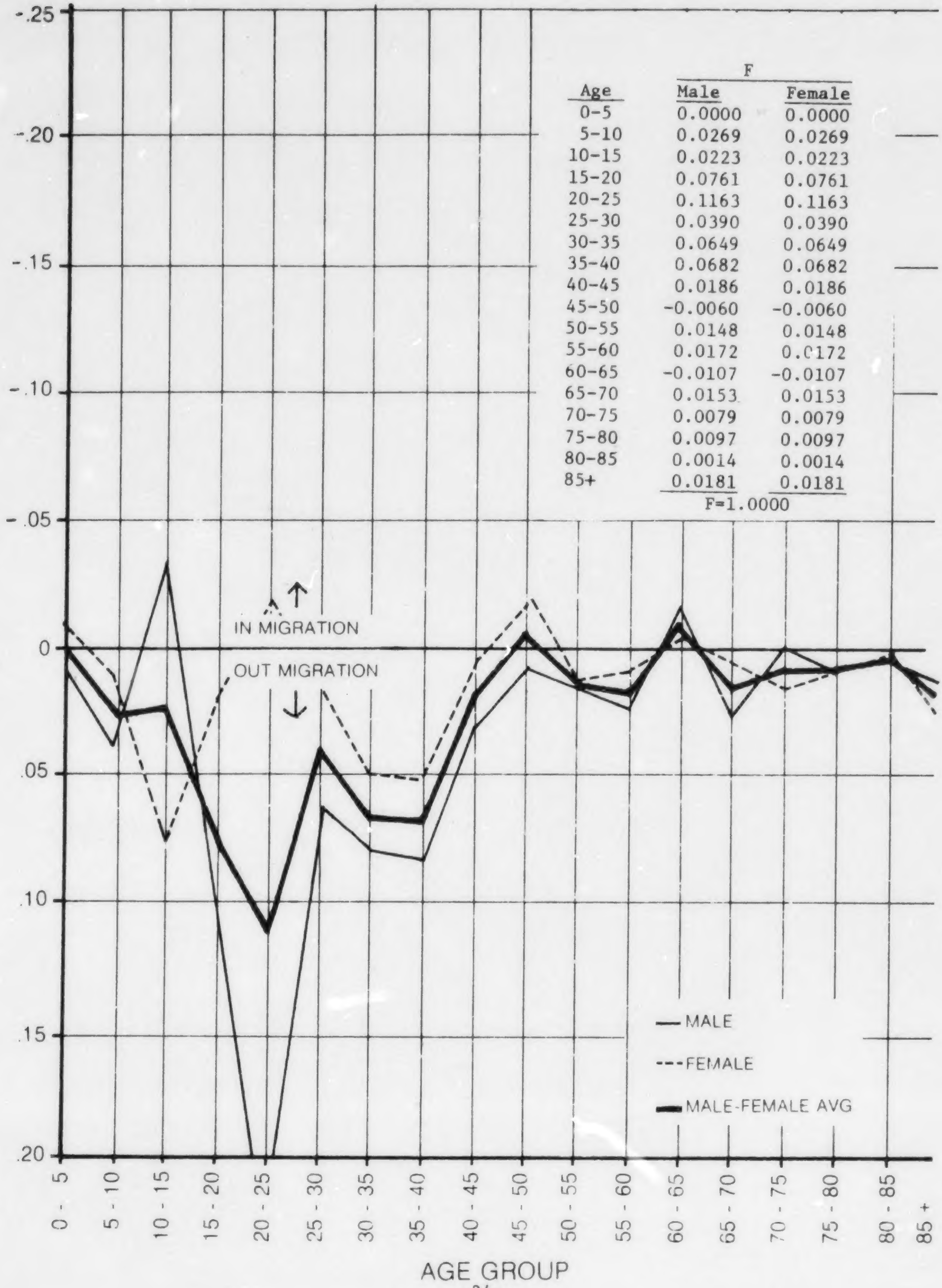
PIRATE COUNTY



	F	
Age	Male	Female
0-5	0.1122	0.0998
5-10	0.0601	0.0543
10-15	-0.0026	0.0039
15-20	-0.0308	0.0201
20-25	0.0924	0.1292
25-30	0.1230	0.1056
30-35	0.0543	0.0272
35-40	-0.0078	-0.0008
40-45	0.0310	0.0343
45-50	0.0286	0.0233
50-55	0.0026	0.0069
55-60	0.0043	0.0079
60-65	-0.0006	0.0006
65-70	-0.0039	0.0047
70-75	0.0033	0.0052
75-80	0.0010	0.0043
80-85	0.0036	0.0089
85+	-0.0011	-0.0050

F=1.0000

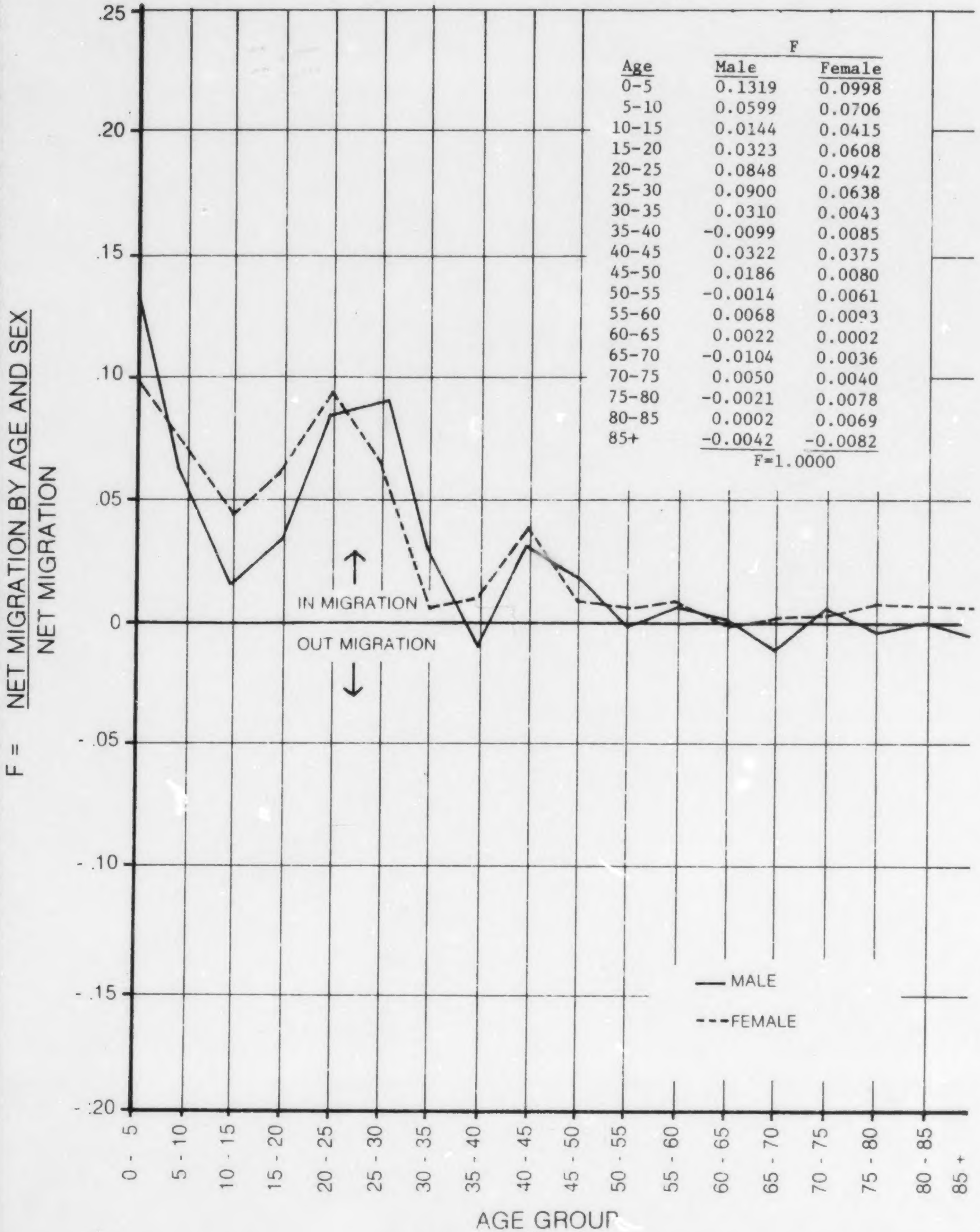
SUB AREA GROUP A



	F	
Age	Male	Female
0-5	0.0000	0.0000
5-10	0.0269	0.0269
10-15	0.0223	0.0223
15-20	0.0761	0.0761
20-25	0.1163	0.1163
25-30	0.0390	0.0390
30-35	0.0649	0.0649
35-40	0.0682	0.0682
40-45	0.0186	0.0186
45-50	-0.0060	-0.0060
50-55	0.0148	0.0148
55-60	0.0172	0.0172
60-65	-0.0107	-0.0107
65-70	0.0153	0.0153
70-75	0.0079	0.0079
75-80	0.0097	0.0097
80-85	0.0014	0.0014
85+	0.0181	0.0181

F=1.0000

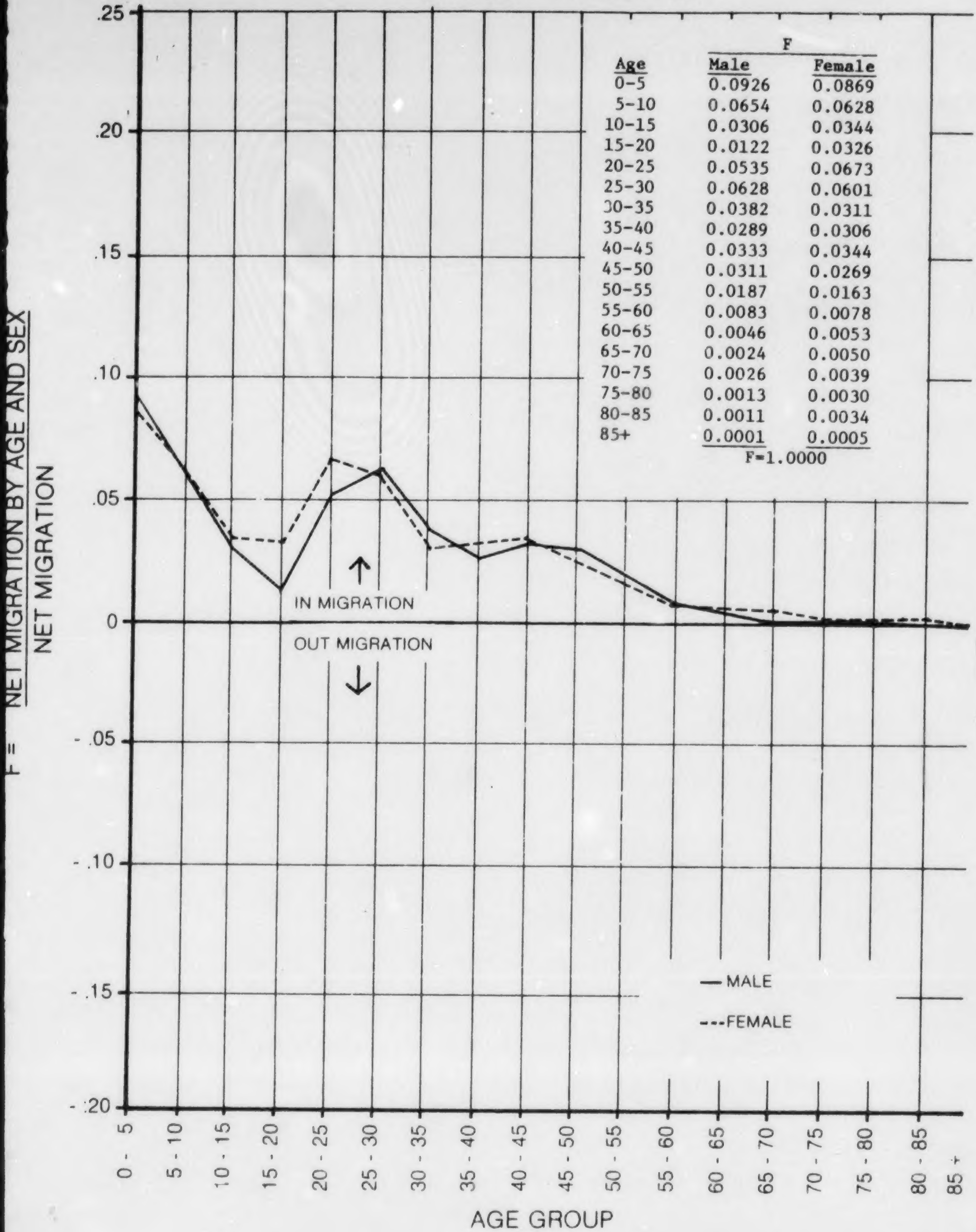
SUB AREA GROUP B



Age	F	
	Male	Female
0-5	0.1319	0.0998
5-10	0.0599	0.0706
10-15	0.0144	0.0415
15-20	0.0323	0.0608
20-25	0.0848	0.0942
25-30	0.0900	0.0638
30-35	0.0310	0.0043
35-40	-0.0099	0.0085
40-45	0.0322	0.0375
45-50	0.0186	0.0080
50-55	-0.0014	0.0061
55-60	0.0068	0.0093
60-65	0.0022	0.0002
65-70	-0.0104	0.0036
70-75	0.0050	0.0040
75-80	-0.0021	0.0078
80-85	0.0002	0.0069
85+	-0.0042	-0.0082

F=1.0000

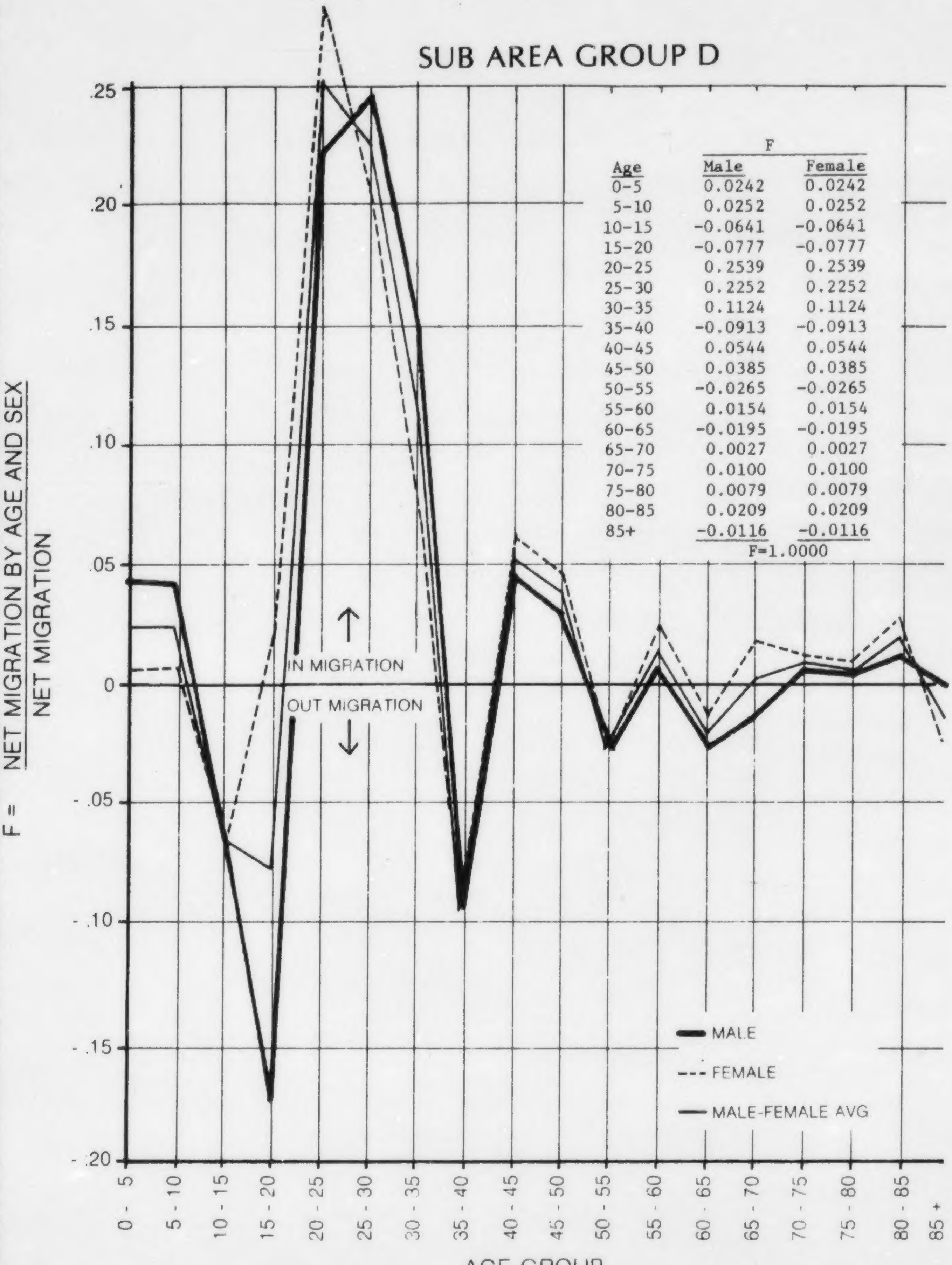
SUB AREA GROUP C



Age	F Male	F Female
0-5	0.0926	0.0869
5-10	0.0654	0.0628
10-15	0.0306	0.0344
15-20	0.0122	0.0326
20-25	0.0535	0.0673
25-30	0.0628	0.0601
30-35	0.0382	0.0311
35-40	0.0289	0.0306
40-45	0.0333	0.0344
45-50	0.0311	0.0269
50-55	0.0187	0.0163
55-60	0.0083	0.0078
60-65	0.0046	0.0053
65-70	0.0024	0.0050
70-75	0.0026	0.0039
75-80	0.0013	0.0030
80-85	0.0011	0.0034
85+	0.0001	0.0005

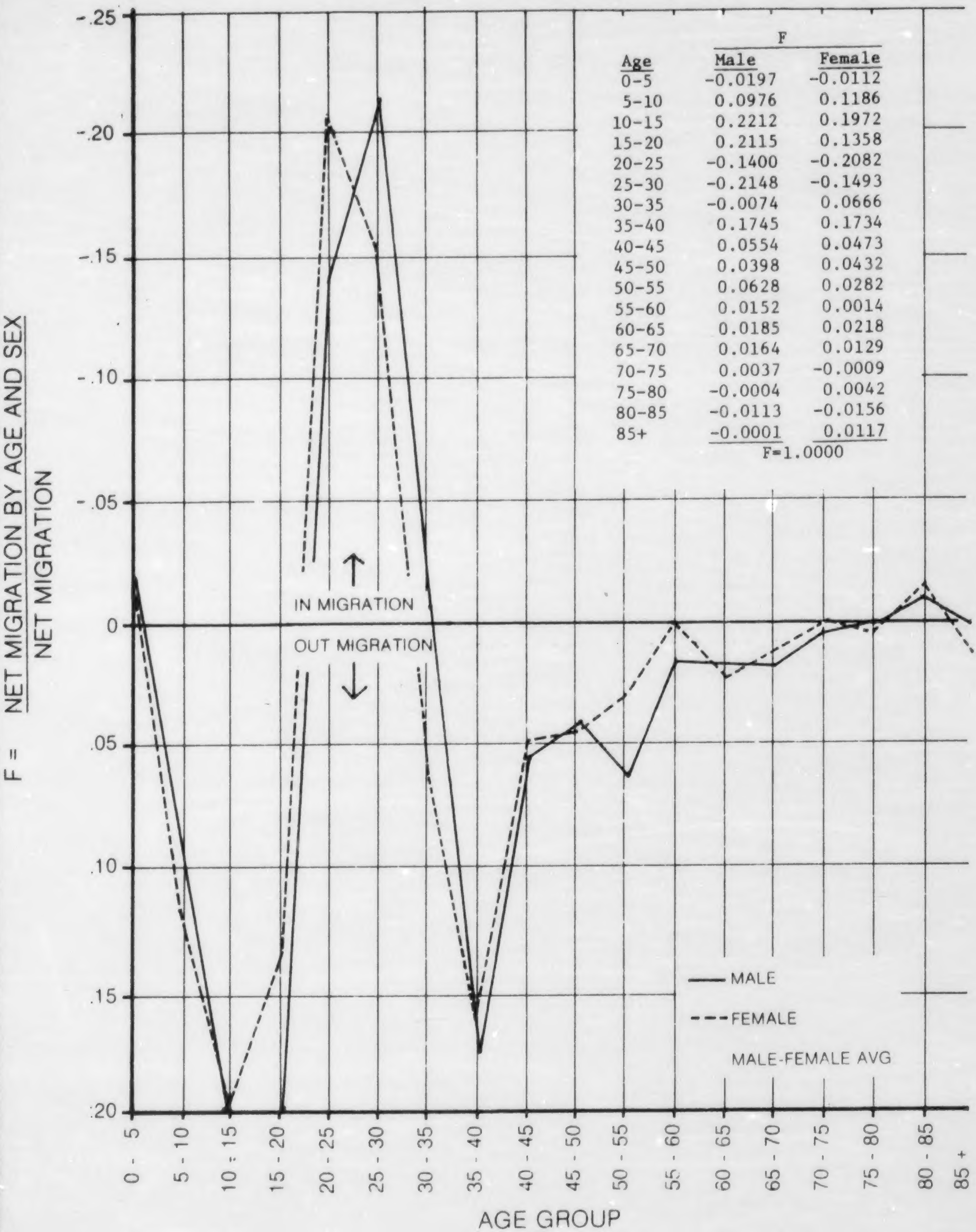
F=1.0000

SUB AREA GROUP D



	F	
Age	Male	Female
0-5	0.0242	0.0242
5-10	0.0252	0.0252
10-15	-0.0641	-0.0641
15-20	-0.0777	-0.0777
20-25	0.2539	0.2539
25-30	0.2252	0.2252
30-35	0.1124	0.1124
35-40	-0.0913	-0.0913
40-45	0.0544	0.0544
45-50	0.0385	0.0385
50-55	-0.0265	-0.0265
55-60	0.0154	0.0154
60-65	-0.0195	-0.0195
65-70	0.0027	0.0027
70-75	0.0100	0.0100
75-80	0.0079	0.0079
80-85	0.0209	0.0209
85+	-0.0116	-0.0116
	F=1.0000	

SUB AREA GROUP E



	F	
Age	Male	Female
0-5	-0.0197	-0.0112
5-10	0.0976	0.1186
10-15	0.2212	0.1972
15-20	0.2115	0.1358
20-25	-0.1400	-0.2082
25-30	-0.2148	-0.1493
30-35	-0.0074	0.0666
35-40	0.1745	0.1734
40-45	0.0554	0.0473
45-50	0.0398	0.0432
50-55	0.0628	0.0282
55-60	0.0152	0.0014
60-65	0.0185	0.0218
65-70	0.0164	0.0129
70-75	0.0037	-0.0009
75-80	-0.0004	0.0042
80-85	-0.0113	-0.0156
85+	-0.0001	0.0117
	F=1.0000	

MODIFIED COHORT PROBLEM

PIRATE COUNTY MALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migration
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

MODIFIED COHORT PRCBLEM

PIRATE COUNTY FEMALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migration
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

MODIFIED COHORT PROBLEM

SUBAREA A MALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migration
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

MODIFIED COHORT PROBLEM

SUBAREA A FEMALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migratio
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

MODIFIED COHORT PROBLEM

SUBAREA B MALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migrat
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

MODIFIED COHORT PROBLEM

SUBAREA B FEMALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migrati
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

MODIFIED COHORT PROBLEM

SUBAREA C MALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migrati
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

MODIFIED COHORT PROBLEM

SUBAREA C FEMALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migratio
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

MODIFIED COHORT PROBLEM

SUBAREA D MALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migration
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

MODIFIED COHORT PROBLEM

SUBAREA D FEMALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migratio
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

MODIFIED COHORT PROBLEM

SUBAREA E MALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migrat
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

MODIFIED COHORT PROBLEM

SUBAREA E FEMALE POPULATION
1970-72

	1970			1971			1972		
Age	Population	Deaths	Migration	Population	Deaths	Migration	Population	Deaths	Migratio
Under 1									
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
.									
.									
.									

ASSIGNMENT MATERIAL: MODIFIED COHORT SURVIVAL

For your subarea, project population by sex and one year increments for ages 0-20 for 1971 using modified cohort survival model.

The following problems illustrate the "what if" capability of a model.*

For your subarea, project population by sex and 5-year age groups for 1975 to 1985 by 5-year increments.

1) Assume birth rates and death rates remain unchanged and,

   a) Assume no migration - let net migration equal .001.

   b) Assume migration per year continues at the average per year for the decade 1960-70. (Divide the decade migration by 10).

   c) Assume migration per year continues at one-half the rate for the decade 1960-70.

2) Assume birth rate decreases by fifty percent while death rates remain unchanged and,

   a) Assume no migration - let net migration equal .001.

   b) Assume migration per year continues at the average per year for the decade 1960-70. (Divide the decade migration by 10).

   c) Assume migration per year continues at one-half the rate for the decade 1960-70.

3) Assume death rate decreases by twenty-five percent while birth rates remain unchanged and,

   a) Assume no migration - let net migration equal .001.

   b) Assume migration per year continues at the average per year for the decade 1960-70. (Divide the decade migration by 10).

   c) Assume migration per year continues at one-half the rate for the decade 1960-70.

* Optional problems for those desiring additional practice. Access to computer facilities is desirable.

Sample Computer Program

Program COHORT

Input

Starting year

Ending year

Increment for printout (Denoted k, this means printout will be obtained for every k years after the starting year).

Interval for age group printout (Denoted j, this means printout will appear by age groups j, 2j, 3j ,...).

Birth rate Type - use type 1 which denotes births are function of women's age.

Birth rate fraction - denotes whether fertility rates will increase or decrease (1 denotes no change, 0.8 denotes twenty percent decrease, 1.5 denotes fifty percent increase).

Death rate fraction - denotes whether death rates will increase or decrease (1 denotes no change, 0.8 denotes twenty percent decrease, 1.5 denotes fifty percent increase).

Data File Name

Net migration for starting year

Net migration for ending year

Output Projected population, deaths, migration by age groups and sex for specified years.

Available Files

All the files contain 1970 population data by age and sex for five-year age groups together with the migration factors. Migration factors assume that a subarea maintains its same sex and age distribution with respect to net migration each year.

COHRPIR	Pirate County
COHRA	Subarea A
COHRB	Subarea B
COHRC	Subarea C
COHRD	Subarea D
COHRE	Subarea E

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Sample

```
FOR,OLD,COHORT

READY.
RUN

 07/03/73. 13.35.18.
PROGRAM   COHORT


ENTER STARTING & ENDING YEAR, PRINT DELTA YRS,& PRT. AGE INTERVALS
 ? 1970,1971,1,10
ENTER YR, %(FRACTION) TO BE APPLIED TO BIRTH RATES & TYPE
 ? 1971,1,1
ENTER YR & %(FRACTION) TO BE APPLIED TO DEATH RATES
 ? 1971,1
ENTER MIG.& START P FL.NAME,YR1,NET MIG1,YR2,NET MIG2
 ? COHRPIR,1970,8505,1971,8505
YEAR =  1971
      1971    1970    1970    1971    1970    1970
AGE  M POP   M MIG   M DEA   F POP   F MIG   F DEA
 10  31433    1465      61   29727    1311      40
 20  32275    -284      16   31812     204       9
 30  20461    1832      13   24782    1997      10
 40  20450     395      28   21281     225      18
 50  20854     507      73   21502     490      42
 60  14860      59     132   15107     126      74
 70   7766     -38     185    8584      45     119
 80   3263      37     197    4763      81     181
 90   1022      21     130    2283      33     207
100     45       0       0     100       0       0
110      0       0       0       0       0       0
  0 152428    3994     834  159940    4511     700
YEAR =  1972
      1972    1971    1971    1972    1971    1971
AGE  M POP   M MIG   M DEA   F POP   F MIG   F DEA
 10  32065    1465      67   30255    1311      44
 20  33236    -284      17   32912     204       9
 30  22146    1832      15   26640    1997      11
 40  21557     395      28   22272     225      18
 50  21041     507      74   21882     490      44
 60  15772      59     139   16047     126      79
 70   8193     -38     194    9061      45     126
 80   3379      37     204    4955      81     191
 90   1045      21     130    2306      33     211
100     87       0       8     198       0      13
110      0       0       0       0       0       0
  0 158521    3994     875  166526    4511     748
 STOP.
```

V. ENROLLMENT PROJECTIONS BY AGE GROUP AND SUBAREA

PIRATE COUNTY COMMUNITY COLLEGE FRESHMAN ENROLLMENT BY AGE GROUP AND SUBAREA
1970-73

		Age Group				
Year	Subarea	15-19	20-29	30-49	50+	Total
1970	A	42	13	3	2	60
	B	90	90	42	18	240
	C	240	60	90	30	420
	D	60	90	150	60	360
	E	60	90	180	90	420
	Total	492	343	465	200	1500
1971	A	50	18	4	3	75
	B	128	110	58	25	321
	C	346	97	125	47	615
	D	81	113	188	84	466
	E	82	105	227	109	523
	Total	687	443	602	268	2000
1972	A	65	21	4	3	93
	B	156	147	76	32	411
	C	438	123	162	63	786
	D	102	161	226	106	595
	E	103	125	262	125	615
	Total	864	577	730	329	2500
1973	A	78	18	4	4	104
	B	195	186	93	37	511
	C	528	162	198	78	966
	D	114	204	264	129	711
	E	114	150	294	150	708
	Total	1029	720	853	398	3000

PIRATE COUNTY COMMUNITY COLLEGE FRESHMAN PARTICIPATION BY SUBAREA AND AGE GROUP
1970-73

	Age Group			
Subarea	15-19	20-29	30-49	50+
A	.0704	.0134	.0020	.0017
B	.0238	.0136	.0048	.0029
C	.0281	.0055	.0043	.0024
D	.0159	.0149	.0134	.0063
E	.0133	.0118	.0128	.0064

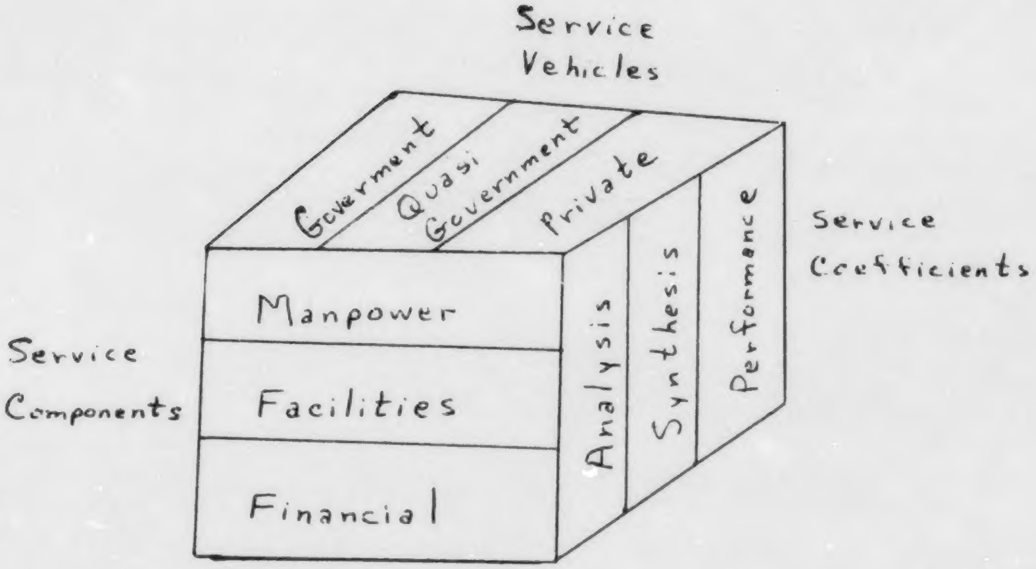
PROJECTED PIRATE COUNTY POPULATION BY AGE GROUP AND SUBAREA

		Age Group				
Year	Subarea	15-19	20-29	30-49	50+	Total
1975	A	927	1159	1750	1730	
	B	6733	12158	15835	10764	
	C	15456	29092	41309	30990	
	D	5450	12254	14354	16640	
	E	6493	10952	17526	20033	
	County	35059	65615	90774	80157	
1980	A	838	1194	1518	1829	
	B	7551	15785	19680	13273	
	C	16226	36625	54753	42614	
	D	4651	14102	19558	18714	
	E	5367	13478	16879	20804	
	County	34633	81184	112388	97234	
1985	A	698	1259	1283	1800	
	B	8373	18059	25627	15467	
	C	12554	38543	72481	55276	
	D	3844	13334	27087	19710	
	E	3405	12512	18703	19911	
	County	28874	83707	14581	112164	

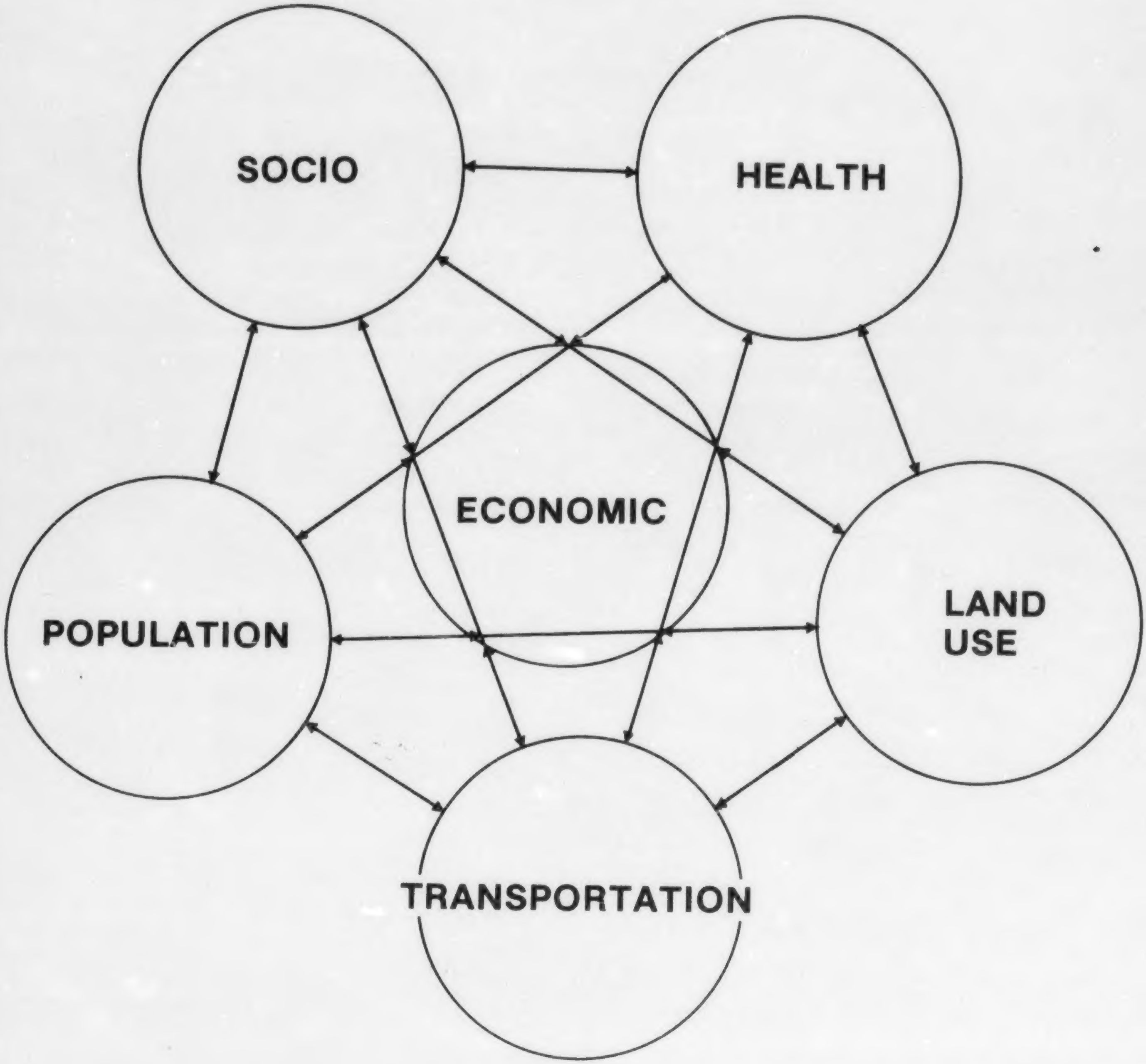
PROJECTED PIRATE COUNTY COMMUNITY COLLEGE FRESHMAN ENROLLMENT BY AGE GROUP AND SUBAREA

		Age Group				
Year	Subarea	15-19	20-29	30-49	50+	Total
1975	A					
	B					
	C					
	D					
	E					
	County					
1980	A					
	B					
	C					
	D					
	E					
	County					
1985	A					
	B					
	C					
	D					
	E					
	County					

VI. SUPPLEMENTARY MATERIAL


Service
Vehicles
Goverment
Quasi
Government
Private
Service
Coefficients
Analysis
Synthesis
Performance
Service
Components
Manpower
Facilities
Financial

PLANNING MODEL


SOCIO
HEALTH
ECONOMIC
POPULATION
LAND USE
TRANSPORTATION

ZONE CROSS REFERENCE TABLES NEEDED

(1)	Political Townships Vs	Township-	Range-	Section-	¼Sec.-	¼¼Sec.
(2)	1960 Census Tract Vs	"	"	"	"	"
(3)	1960 City Boundaries Vs	"	"	"	"	"
(4)	1960 School District Vs	"	"	"	"	"
(5)	1970 Census Tract & Block Vs	"	"	"	"	"
(6)	1970 Unblocked Census Tracts Vs	"	"	"	"	"
(7)	Current School District Vs	"	"	"	"	"
(8)	Current S.M.Elem.Attend.Areas Vs	"	"	"	"	"
(9)	Current S.M.Jr.H.S.Attend.Areas Vs	"	"	"	"	"
(10)	Current S.M.H.S.Attend.Areas Vs	"	"	"	"	"
(11)	Parochial School Dist. Vs	"	"	"	"	"

OTHER CROSS REFERENCE TABLES NEEDED

(1)	1960 Residential Factor	by Township-Range-Section-¼Section-¼¼Sectio					
(2)	1970 Residential Factor in Unblocked Areas	by	"	"	"	"	"
(3)	School Location	by	"	"	"	"	"
(4)	Area (sq. miles)	by	"	"	"	"	"
	Area "	by 1970 Census Tracts					
	Area "	by 1960 Census Tracts					
	Area "	by Political Twn.					
	Area "	by 1960 Boundary					
	Area "	by Current S.M. Attendance Area					
	Area "	by Current School District					
	Area "	by 1960 School District					
	Area "	by Political Twn. minus 1960 City					
(5)	Desired Holding Density or capacity (Pop/Area)	by Township-Range-Section-¼Section-¼¼Se					

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POLITICAL TOWNSHIP WITH TWN-

SAMPLE CROSS REFERENCE TABLE
Political Townships Vs Township
Range-Section-¼Sec.-¼¼Sec.

POLITICAL TOWNSHIP NAME	POL TWN #	TWN	RANGE	SEC.	¼ SEC	¼¼ SEC	%
SHAWNEE	12	13	24	9	1	3	100
					1	4	
					2	1	
						2	
						3	
						4	
				10	1	1	
						2	
						3	
						4	
					2	1	
						2	
						3	
						4	
				11	1	1	
						2	
						3	
						4	
					2	1	
						2	
						3	
						4	
				12	1	1	
						2	
						3	
						4	
SHAWNEE	2	13	24	12	2	1	100
					2	2	

* Level 1 = Elem
2 = Jr Hi
3 = Sr Hi

㊳ ATTEND AREA

SCHOOL/DISTRICT NAME	DIST	LEVEL*	ATTEND AREA	TWN	RANGE	SEC	¼ SEC	¼ ¼ SEC	%	
DOROTHY MOODY	512	1	138	13	24	1	4	4	100	
						12	1	1	100	
								2	100	
								3	75	
								4	80	
DOROTHY MOODY	512	1	138	13	24	12	2	1	100	
								2	100	
								3	75	
								4	75	
BLUE JACKET			139	12	24	2				
						3	1		100	
						3	2		100	
FLINT			140	12	24	11	1			
							2			
							3			
							4	1	35	
								2	100	
								3	90	
								4	20	
						10	4	1	15	
						10	4	4	70	
						4	1		100	(Bus area)
							2	1	100	
								2	90	
								3	90	
								4	100	
							3	1	100	
							3	2	90	

SAMPLE CROSS REFERENCE TABLE

Current S.M.Elem.Attend.Areas
Vs Township-Range-Section-
¼Sec.¼¼Sec.

BEST COPY AVAILABLE

(17) ATTEND AREA

* Level 1 = Elem
2 = Jr Hi
3 = Sr Hi

SCHOOL / DISTRICT NAME	DIST	LEVEL	ATTEND AREA	TWN	RANGE	SEC	1/4 SEC	1/4 1/4 SEC	%
HILLCREST	512	2	28	13	24	11	2	2	100
								3	95
								4	90
						12	1	1	100
								2	100
								3	75
								4	80
HILLCREST	**512**	**2**	**28**	**13**	**24**	**12**	**2**	**1**	**100**
								2	100
								3	75
								4	75
				12	24	34	1	4	10
							4	1	70
								3	50
								4	100
						35	1		100
							2	1	100
								2	35
								3	85
								4	100
							3		100
							4		100
						36			
HILLCREST	512	2	28	12	24	25	4	4	20
TRAILRIDGE	512	2	29	13	24	3	2	1	75
								2	100
								3	80
								4	25

SAMPLE CROSS REFERENCE TABLE

Current S.M.Jr.H.S.Attend.
Areas Vs Township-Range-Section
¼Sec.-¼¼Sec.

1555 8-62

BEST COPY AVAILABLE

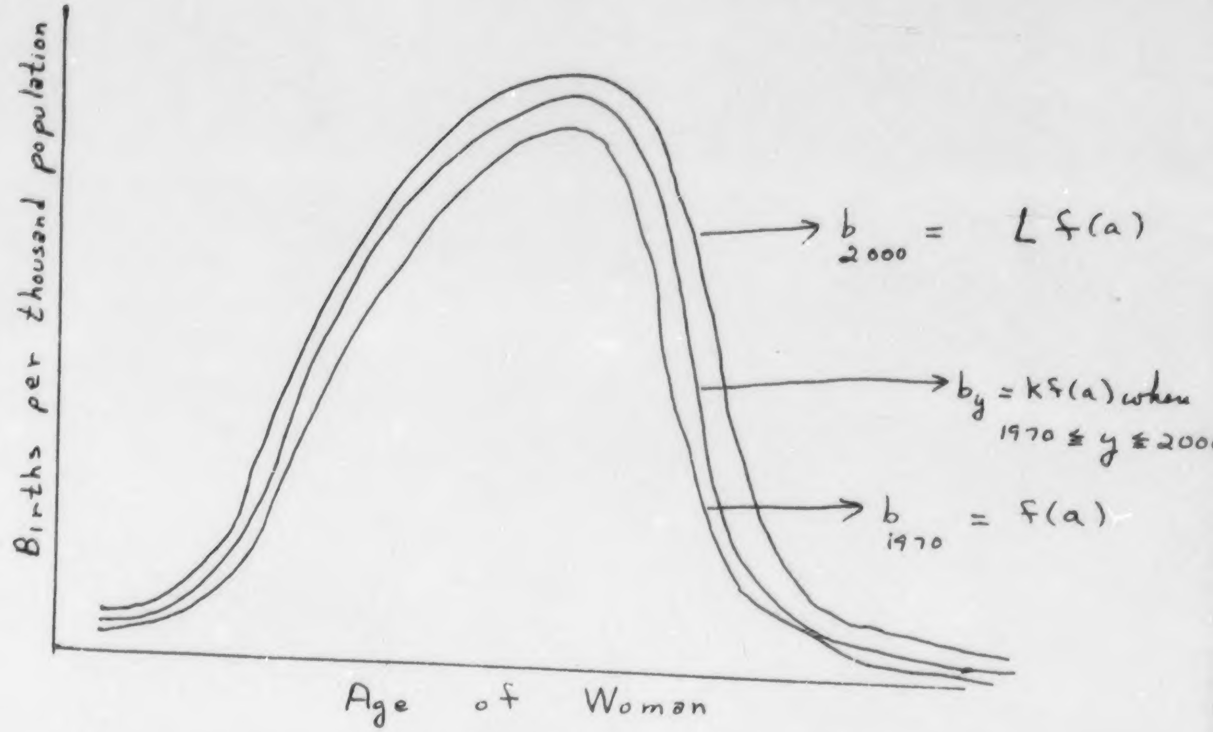
* Level 1 = Elem
2 = Jr Hi
3 = Sr Hi

(10) ATTEND AREA

SCHOOL / DISTRICT NAME	DIST	LEVEL *	ATTEND AREA	TWN	RANGE	SEC	¼ SEC	¼ ¼ SEC	%
SM SOUTH	512	3	14	13	24		4	2	75
								3	100
								4	100
						12	1	1	100
								2	100
								3	75
								4	80
SM SOUTH	**512**	**3**	**14**	**13**	**24**	**12**	**2**	**1**	**100**
								2	100
								3	75
								4	75
SM WEST			13			1	1		100
							2		100
							3	1	15
							3	2	10
							4	1	25
							4	2	25
						2			
						3	1		100
							2	1	25
								3	20
								4	75
							3	1	100
								2	75
								3	100
								4	100
							4		100
						4	4	1	5

SAMPLE CROSS REFERENCE TABLE

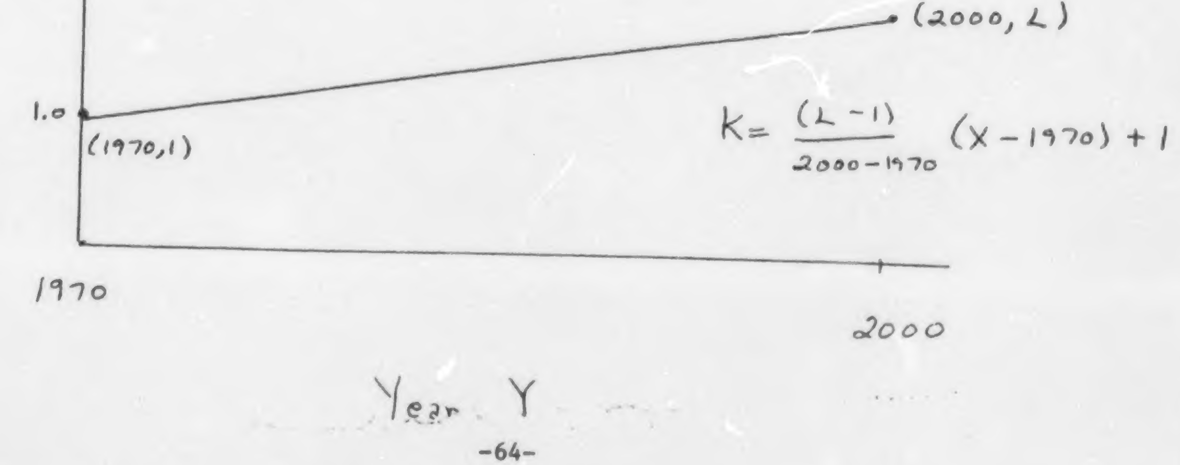
Current S.M.H.S.Attend. Areas Vs Township-Range-Section-¼Sec.-¼¼Sec.

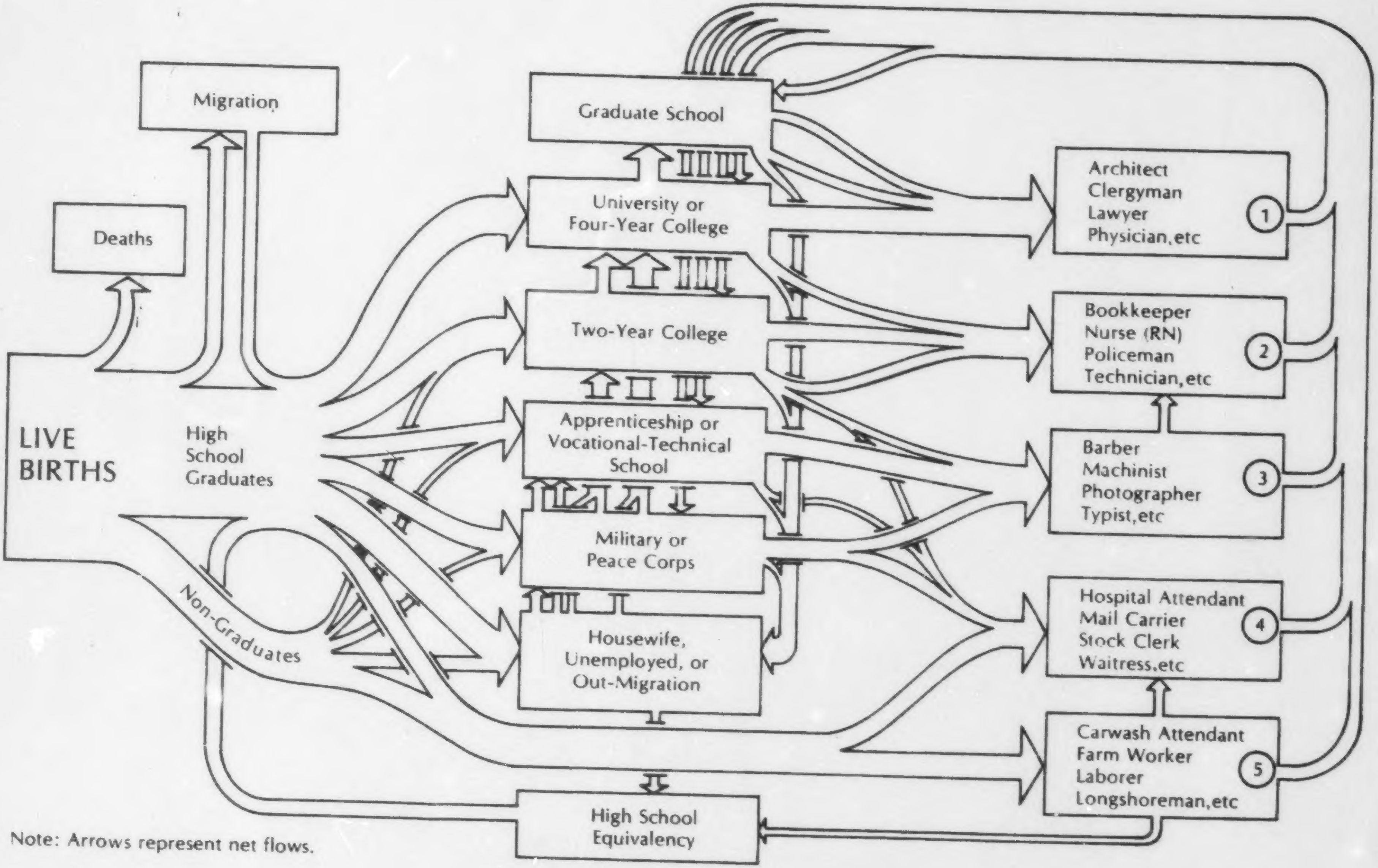


b is births per thousand population for year y

a is age of woman

K is a function of year determined by the two points (1970, 1) and (2000, L)




LIVE BIRTHS
Deaths
Migration
High School Graduates
Non-Graduates
Graduate School
University or Four-Year College
Two-Year College
Apprenticeship or Vocational-Technical School
Military or Peace Corps
Housewife, Unemployed, or Out-Migration
High School Equivalency
Architect Clergyman Lawyer Physician, etc
①
Bookkeeper Nurse (RN) Policeman Technician, etc
②
Barber Machinist Photographer Typist, etc
③
Hospital Attendant Mail Carrier Stock Clerk Waitress, etc
④
Carwash Attendant Farm Worker Laborer Longshoreman, etc
⑤

Note: Arrows represent net flows.

APPENDIX A.

Major Elements of a Community Needs Survey

MAJOR ELEMENTS OF A COMMUNITY NEEDS SURVEY

Presented to

Demographic Planning Seminar

July 9, 1973

by

Institute for Community/College Development
Johnson County Community College
111th & Quivira Road
Overland Park, Kansas

COMMUNITY NEEDS SURVEY

Statement of Purpose

1. To collect, compile, and document county-wide data and information which would serve as the principal resource for planning and coordinating public activities in Johnson County.
2. To analyze county-wide data and information with respect to planning and implementation of community services provided by the College.
3. To maintain and update an effective planning information system for Johnson County.

COMMUNITY NEEDS SURVEY

Information Categories

Economy

Government

Housing & Population Distribution

Education & Cultural Services

Recreation

Church/Community Activities

Public Assistance

Health

Family & Child Services

Others

Economy

- Business and Industry (basic data, e.g., types and numbers, retail sales, payrolls, geographic distribution, etc.)
- Government (effect on economy as employer payroll, etc.)
- Agriculture (basic data, role in economy, etc.)
- Utilities (basic data, role in economy, etc.)

- Labor Force
    - occupation groups
    - age distribution
    - sex distribution
    - income groups

- Planning
    - needs of economy
    - economic trends & projections

Government

- Units
    - definition & enumeration
    - functions
- Organization
- Revenue & fiscal planning
- Budgets
- Elections
- Planning & zoning
- Courts
- Law enforcement
- Fire protection
- Civil defense

Housing & Population Distribution

- Census statistics (population & housing)
  - enumeration
  - classification
- Neighborhood facilities (e.g., streets, sidewalks, lighting, water, sewers, etc.)
- Neighborhood proximities (e.g., distances to hospitals, shopping centers, fire stations, schools, etc.)
- Planning
  - home building trends & projection
  - population distribution trends
  - clearance & redevelopment
  - maintenance to avoid blight

Education & Cultural Services

- Types (e.g., schools, libraries, museums, etc.)
  - definitions & enumeration
  - functions
- Revenue & fiscal planning
- Facilities available for community use
- Public events
- Health services for students
- Special services (e.g., for veterans, women, senior citizens, disadvantaged, handicapped, etc.)
- Vocational education
- Adult continuing education
- Use of out-of-county facilities by Johnson County residents
- Planning
  - projection of needs
  - site development
  - resource development & allocation

Recreation

- Public recreation
  - services
  - facilities
  - staff

- Other non-profit recreation (e.g., YMCA, YWCA, churches, etc.)

- Commercial recreation

- Private recreation (e.g., clubs, industry, etc.)

- Individual use of leisure time

- Use of out-of-county facilities by Johnson County residents

- Planning
  - projections of needs
  - site & facility development
  - resource development & allocation

Church/Community Activities

- Churches
- Church-related agencies
    - educational
    - social
- Church-sponsored recreation/social activities
- Special services to ill and handicapped members
- Church facilities available for community use
- Community services (e.g., family counseling, adolescent problems, intergroup relations, etc.)
- Use of out-of-county facilities by Johnson County residents

Public Assistance

- Types of agencies
  - definition & enumeration
  - functions

- Revenue & expenditures

- Facilities

- Recipients
  - definition & enumeration
  - eligibility & allowances
  - rehabilitation & prevention of dependency

- Citizen information & attitude

- Planning
  - projections of needs
  - resource development & allocation

Health

- County health statistics (e.g., state of health of residents, frequency of health problems, distribution of health problems, etc.)
- Public health services
  - types
  - functions
  - client characteristics
- Hospitals & allied services (e.g., ambulance, laboratories, etc.)
- Health-related services (e.g., food inspection, waste disposal, water, vermin control, etc.)
- Health personnel & organizations
- Accidents & accident prevention
- Communicable diseases
- Chronic diseases
- Alcoholism and drugs
- Mental health
- Use of out-of-county facilities by Johnson County residents

Family & Child Services

- Enumeration statistics (e.g., average family size, age distribution, birth rates, marriage & divorce statistics, etc.)
- Legislation affecting family & children
- Courts, law enforcement, detention
- Special services in the home
- Child care
- Safeguarding children (e.g., neglected, maltreated, molested, etc.)
- Children with problems
  - identification
  - prevention
  - treatment
- Agencies and citizens organizations
- Use of out-of-county facilities by Johnson County residents

Others

- Communications & mass media
- Associations
- Inter-agency programs

APPENDIX B.

Sample Proposal (Phase I): Development of an Educational Enrollment Model for Johnson County

DEVELOPMENT OF AN EDUCATIONAL ENROLLMENT MODEL FOR JOHNSON COUNTY, KANSAS

A Prospectus

To be Considered

by

The Board of Trustees
Johnson County Community College
Shawnee Mission, Kansas

February 24, 1972

PREFACE

This prospectus describes a project that has been under consideration for several months and which is now submitted to the JCCC Board of Trustees for final action. The primary objective of the would-be project is the development of an educational enrollment model applicable to public and private schools in Johnson County and to Johnson County Community College.

The project would be planned and implemented by the College's Institute for Community College Development. It is proposed that funding be shared by the two principal users of the enrollment model -- Shawnee Mission Unified School District and Johnson County Community College. On January 24, 1972 the Shawnee Mission School Board authorized the expenditure of $11,700 for this purpose. No JCCC funds above that currently budgeted for planning would be required.

It is anticipated that the project would be carried out over a time span of seven months. Based on Board authorization effective February 24, the estimated start-up and termination dates would be March 15 and October 15, respectively.

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I. BACKGROUND INFORMATION

Development and implementation of educational and community service programs at Johnson County Community College is based on recognition of the importance of comprehensive planning information. The first priority in program design is the collection, compilation and analysis of data which define and measure outcomes in terms of institutional and community needs. This can take the form of individual planning studies addressed to narrowly specified objectives or comprehensive surveys and interpretations of broader educational or community service needs. The 1969 educational needs survey of Johnson County is an example of the latter type of study.[1] This survey was conducted by the JCCC Institute for Community College Development to serve as a planning base for the design of the inaugural academic and vocational education programs offered by the College.

Planning data requirements can be categorized in the same manner. That is, certain types of data are sufficient for short-range planning activities associated with specific objectives. Long-range planning and short-range projects of a more inclusive nature require more comprehensive data. As data requirements become increasingly comprehensive, the information compiled for planning purposes can be utilized by an increasing number of agencies and organizations. Much of the community data and information required by Johnson County Community College in planning and developing its staff, programs, services and facilities can also be utilized by other service agencies of Johnson County.

A survey of community-oriented, informational functions of possible mutual interest to JCCC and other County agencies was conducted during the fall semester of the current fiscal year. From the envelope of possible studies, the four specific options summarized in Tables 1 and 2, were described at a meeting of the JCCC Board of Trustees on November 9, 1971. The staff subsequently explored the feasibility of various funding arrangements. Based on an assessment of the relative advantages and disadvantages of the six cooperative planning projects summarized in Table 3, it was concluded that Option C funded jointly by the Shawnee Mission School District and Johnson County Community College would offer the greatest benefit in terms of cost-effectiveness and objectives. In short, this project would enable the districts to share the expense of attaining one of the most important educational planning priorities: the development of reliable, long-range enrollment projections.

Subsequent discussions with Shawnee Mission staff and Board personnel resulted in a revised project statement designed to best serve the two districts and the educational community as a whole. The need for the proposed enrollment projection capability is discussed in Section II. A statement of the project objectives and scope are included in Section III. Existing data and applicable methodology are inventoried in Section IV, and the proposed technical approach to the compilation of available data, the development of the enrollment projection model and application of the model are presented in Section V. Section VI contains an outline of the project organization and schedule. The estimated project costs are delineated in Section VII.

TABLE 1

OPTIONS: JCCC COMMUNITY-ORIENTED, INFORMATIONAL PLANNING FUNCTIONS BY OUTCOME AND STAFFING REQUIREMENT

	Outcome (See Table 2)				Staff Requirements in Man-Months	
Option	Needs Report (1, 2)	Organization of Data (3)	Enrollment Projections (4)	Comprehensive Needs Survey (5)	Professional	Clerical
A	X				10	2
B	X	X			12	5
C	X	X	X		18	7
D	X	X	X	X	42	14

TABLE 2

DESIRED OUTCOMES: JCCC COMMUNITY-ORIENTED, INFORMATIONAL PLANNING FUNCTIONS BY USE AND USER

Outcome	Principal Use	Principal User
1. Report on community services needs	Identify needs and establish priorities for community services programs	Office of Community Cooperation (JCCC)
2. Report on adult continuing education needs	Identify needs and establish priorities for non-credit courses	Division of Adult Continuing Education (JCCC)
3. Reports summarizing basic demographic data for Johnson County	Analysis of short-range educational resource requirements	·Institute for Community College Development (JCCC) ·Johnson County Unified School Districts
4. Projections of elementary and secondary enrollment by attendance center	Predict long-range elementary and secondary resource requirements	Johnson County Unified School Districts
5. Comprehensive needs survey with interim proposal defining alternate systems	Provide a basic system of County-wide planning information	Johnson County Community College

TABLE 3

COMPARISON OF JCCC COMMUNITY-ORIENTED INFORMATIONAL PLANNING OPTIONS BY FUNDING GROUPING

Option (See Tables 1 and 2)	Possible Funding Group or Consortium	Start-up and Terminal Dates	Advantages	Disadvantages
B	JCCC	2-1-72 9-1-72	Early start-up Redirection:15 days* No imposition**	No external funds Min. utility
C	JCCC USD 512	3-15-72 10-15-72	Early start-up Redirection:31 days* Min. imposition** Public image Cost sharing	
B + Outcome 5	JCCC Governmental agencies	3-15-72 3-15-73	Early start-up Redirection:37 days* Cost sharing Possible on-going funding	Max. imposition** Possible political complexities
D	JCCC USD 512 Governmental agencies	3-15-72 3-15-73	Early start-up Cost sharing Possible on-going funding Max. utility	Redirection:42 days* Max. imposition** Possible political complexities
D	JCCC USD 512 Governmental agencies Other agencies	4-15-72 4-15-73	Cost sharing Possible on-going funding Max. utility Ease data inventory	Redirection:67 days* Max. imposition** Possible political complexities
D	JCCC USD 512 Other agencies (excluding governmental)	4-15-72 4-15-73	Cost sharing Max. utility Ease data inventory Public image Min. imposition**	Redirection:72 days*

* Refers to man-days of effort redirected from other JCCC priorities. "Redirected effort" includes proposal preparation, presentations, staff recruiting and low-yield fund raising.

** Refers to imposition of external goals of non-JCCC agencies.

II. THE NEED

Reliable enrollment projections are perhaps the most important element of planning for any educational agency or institution. Short-range and long-range predictions of enrollment are the basis for the allocation of educational resources including staff, facilities, support services and finances. On a short-term basis, the accuracy of the budget, the number of staff, the availability and allocation of funds and numerous other related factors depend directly on the ability to accurately forecast the number of students which the agency or institution must serve in the period for which it is planning. Reliable enrollment projections are essential in long-range planning in order to anticipate the changes in facilities and revenue required to meet future demands.

If a method of predicting enrollment is to be used as a basis for planning, it must be much more than a number generator. It must be able to accommodate observable trends in the many factors which influence enrollment. For example, if the average age of the residents of a certain attendance area is observed to be gradually increasing as indicated by census statistics or other data, and the available data are adequate to enable this trend to be projected into the future, this influence should be incorporated into the enrollment projection method.

On the other hand, there are changes in controlling factors which can not be reliably forecast. For example, a landmark legislative decision regarding some facet of the community might have a marked influence on future elementary, secondary or postsecondary enrollment distribution. If such an action cannot be described in terms of observable descriptive data, it likewise could not be integrated into the enrollment projection method. However, non-quantifiable changes could be accommodated by the method. Thus, when the effects of non-quantifiable changes on demographic parameters are independently defined, the enrollment projection method must be responsive to these conditions by means of data base revisions.

In summary, a procedure is needed to provide long-range enrollment projections based on pertinent Johnson County socioeconomic trends. It is important that the technique provide maximum interaction with the educational decision maker. The required procedure could be thought of as an enrollment model capable of estimating future public and private enrollments by school attendance center and providing a means of aggregating these data for use in projecting Johnson County Community College enrollments.

III. OBJECTIVES AND SCOPE

The primary objective of the proposed project is:

> To develop an educational model to make long-range enrollment projections for each Johnson County public and private attendance center (elementary, junior high, senior high and JCCC) and for districts as a whole by grade and sex.

The proposed model will be a computer-based tool for the simulation of events in a system of interactive institutions. It will be designed to enable the educational planner to predict and analyze future consequences of action proposed for the structure and operation of the system.

The model must provide the following enrollment projection capabilities:

1. Projection of the existing system: An obvious utility of the model will be to simulate the future structure and operation of the Johnson County educational system based on current enrollment trends. This use is addressed to the question: To what extent will the system satisfy future enrollments if no changes are implemented?

2. Projection of the system with the establishment of new attendance centers: This use will be applicable to the effect of the creation of one or more new attendance centers on the future operation of both the original and the newly established system.

3. Projection of the system with attendance center closure: This application of the model will deal with the effect of the closure of one or more attendance centers upon the continued operation of the remaining segments of the system. An example of this application would be the conversion of an elementary school to a district-wide learning resource center.

4. Projection of the system with combined establishment and closure of attendance centers: This use will be applicable to a combination of the previous two applications. It would enable the user to analyze plans which call for both the opening and closure of schools. The occurrence of these events could be prescribed to be simultaneous or sequential.

5. Projection of the system to accommodate prescribed trend changes: This application will allow the educational planner to override projected socio-economic and demographic trends pertinent to school population characteristics. Examples: educational participation rates, private/public attendance patterns, percent multi-family dwellings, low income housing, land use factors, net migration, birth rates and labor force characteristics.

IV. DATA AND METHODOLOGY INVENTORY

The first step in the development of enrollment projections is the collection, compilation and correlation of available demographic data and the identification of methodology and available related software. Following is a summary of a preliminary data and methodology inventory.

Available Data

The most important current source of demographic data is the 1970 U. S. Census. The results of the census are not all yet available in the detail required for the proposed project. Data from the First and Second Count Summary Tapes are available and include certain population and housing characteristics by enumeration district, blockgroup and tract. The Metropolitan Planning Commission - Kansas City Region (Metroplan), now MARC, has developed programs for retrieving and reporting data from these summary tapes. Ten reports are currently available from MARC and have been obtained by the College. Additional reports are forthcoming. The same data by block will be included in the Third Count Summary Tape.

Much of the census data desired for the proposed project will be on tapes containing detailed information obtained by sampling. These will include occupation, employment, income and other statistics which influence enrollment patterns. Reports from these tapes are not yet available, however they soon will be released by MARC which will continue to serve as the primary source of basic census information.

Additional projects such as a "Fiscal Analysis Study" of the eight-county metropolitan region are currently underway at MARC. This particular study is being designed to characterize the region in terms of projected revenues, capital improvement capacity, assessed valuation, tax rates and numerous other financial factors. The project has begun with analysis of selected municipalities and initial reports are expected early in 1972. No Johnson County communities are currently being studied but some are included in the project plans. Results will be obtained for the proposed project as they become available.

A "Regional Land Factors Atlas" is also being compiled and will include data on land use, zoning, ordinances governing land use, water and sewer facilities, housing conditions, comprehensive plans of municipalities and related categories. The information is compiled in the form of map overlays based on the Metropolitan Map Series. Data from the atlas will be available for the proposed project.

Other projects of MARC have produced information which will be helpful in the development of enrollment projections. A partial list of final reports which have been obtained by the College is given in Appendix A. These reports contain data describing the Kansas City metropolitan area which are generally not sufficiently disaggregated to serve directly in the proposed project. They do, however, provide a valuable means of verifying aggregated results.

The compilation and interpretation of 1970 census data is the subject of a project proposed by the Institute for Community Studies. The effort is in the initial planning stages and will, if initiated, result in the compilation of census statistics by census tract and total statistical metropolitan area. A similar report was prepared by ICS in 1962 based on the 1960 census.[2] An added feature of the proposed report on the 1970 census is enumeration by smaller administrative area for special analyses. If ICS is successful in securing sponsors, the project is expected to begin early in 1972 and require four to six months to complete. The College has contacted ICS personnel and is monitoring the status of their proposed effort.

Possibly the most important future source of basic population data will be the enumeration survey conducted each year by the Johnson County assessor's office. Census data are collected by city or township, ward, precinct, address, name, birthday, sex and family relationship. In past years, the annual census data have been recorded by hand and therefore their use requires an enormous amount of recompilation effort. Last year the procedure was computerized; however, because of a lack of apparent need for these data by County agencies much of the disaggregated data have been purged. Past County census data are available from the Kansas State Board of Agriculture in Topeka. Discussions have been carried out with the director of County data processing services concerning the attainment of census tapes in the future. It appears that there would be little difficulty in developing softward that would: (1) scratch names to insure confidentiality and (2) provide direct interface between the County census output tapes and the proposed JCCC program data up-date routines.

Another important set of population reports are annual live birth and death data. This information is compiled and disseminated by the Division of Registration and Health Statistics Services in Topeka. The format of the Johnson County reports are not now known by the JCCC staff.

The "Comprehensive Needs and Services Survey" recently conducted to develop information pertaining to the United Fund is only of marginal interest to the proposed project.[3] The study was based principally on qualitative information and provides no quantitative data applicable to the development of enrollment projections. The report will, however, be consulted with reference to the definition of the College's program of community services.

The Mid-America Council of Governments (MACOG), now an integral part of MARC, has initiated regional studies of manpower needs. Although the resulting information would be of peripheral utility in the proposed project, this study and future related programs will be monitored.

Recent manpower studies of the Kansas Master Planning Commission (MPC) for higher education are also available. The MPC has also developed projections of grade twelve enrollments for each school district in Kansas for periods up to 1986.

Several other studies have provided information which are of interest in the development of enrollment projections. These include the feasibility study for a Johnson County sports arena conducted by Midwest Research Institute, publications of organizations such as the League of Women Voters and various municipal governments, studies and reports of the Regional Health and Welfare Council, municipal planning studies, and publications of business and commercial organizations.[4] Examples of this type of data are referenced in Appendix A.

Maximum possible use will also be made of basic data records compiled by Johnson County school districts including available enrollment records, aggregation unit boundary definitions and annual school census data.

Available sources of information related to the proposed project are summarized in Table 4.

Available Methodology

Elementary, secondary, and postsecondary enrollment projections are generally developed around one or more well-established technical methods.[5]

1. Cohort survival involves a determination of the extent to which a defined group of individuals (the cohort) progresses by year of age from birth or by grade from kindergarten. The survival rate computed in this manner is then applied to population projections for a specified attendance area.

2. Correlation analysis is a method in which relationships are developed between enrollment as a dependent variable and various other parameters as independent variables. Enrollment can then be predicted in terms of observed or predicted changes in the independent variables.

3. Ratio Analysis is a technique which describes enrollment in terms of the ratio between current enrollment and the population base from which the students are drawn. This ratio is applied to population projections to yield predictions of future enrollment.

TABLE 4

SOURCES OF AVAILABLE DEMOGRAPHIC AND SOCIOECONOMIC DATA (INCOMPLETE)

Source	Type of Information
Bureau of Census	U.S. decennial census reports
Metropolitan Planning Commission (now MARC)	·1970 U.S.Census Summary Tapes ·Regional Land Factors Atlas (Land-use data, municipality comprehensive plans, zoning data, water and sewer plans, region-origin, transportation plans, open space plans, housing characteristics) ·Fiscal Analysis Study (underway) ·Regional Plans ·Miscellaneous Regional Analyses
Johnson County Assessor and Kansas State Board of Agriculture	·Annual Johnson County population enumeration
Kansas Division of Registration and Health Statistics	·Annual census of live births and deaths
Institute for Community Studies	·Summary and Interpretation of 1970 Census (pending funding)
Mid-America Council of Governments (now MARC)	·Regional Manpower Studies (underway)
Committee for Entertainment Center	·Feasibility Study of Entertainment-Sports-Cultural Complex
Comprehensive Needs and Services Survey Committee	·Comprehensive Needs and Services Survey
Public and private school districts	·Enrollment Records ·Attendance Characteristic Data ·Annual Census
Kansas Master Planning Commission for Higher Education	·Manpower Studies ·Projections of High School Graduates
Other agencies: municipal, County and State government; civic; business and professional	Utility connects and disconnects, OEO studies, BLS manpower and econometric forecasts, voter and vehicle registration...

4. Regression analysis involves the extrapolation of observed historic trends into the future. A relationship between enrollment and time is developed from enrollment records. The curve defined by the relationship is extended to a specified future date.

Each of these methods has its advantages and disadvantages. Furthermore, they can have many elements in common depending on the methodology of the base population projections. Correlation analysis is the method by which the influence of many factors can best be predicted. It yields projections which can independently account for changes in the demographic and socioeconomic characteristics of a community. However, of the four projection methods, correlation analysis requires the most comprehensive input data.

The reliability of enrollment projections made by cohort survival analysis, ratio analysis, or regression analysis depends on the accuracy of the population projections to which the method is applied. None of these three methods are well-suited for application to attendance areas which are characterized by rapidly changing population or economic conditions unless the underlying population projections are adequate to predict such changes. The three techniques assume that the conditions of the past can be reliably extended to the future.

The demographic and socioeconomic nature of Johnson County has been undergoing comparatively rapid change due principally to in-migration from other parts of the Kansas City metropolitan area and the socioeconomic mobility of the residents. The 1970 U.S. Census, however, indicates that the population growth of the County and of the Nation has not been as rapid as was predicted on the basis of trends observed in the early 1960's. Although the population of the County has not changed as rapidly as was originally expected, its rate of change remains sufficient to detract from the reliability of enrollment projections based on extrapolation of current trends.

The mobility of the population within the County and changing age characteristics present additional complications to the projection of elementary and secondary enrollment by attendance area. For example, Johnson County educators recognize the implication of the fact that some areas of the County are beginning to stabilize demographically and the average age of the area population is increasing. This gradually decreases the school-age population in that area. Simultaneously, other regions of the County are undergoing phases of accelerated home building with accompanying growth in the school-age population.

These factors indicate that the preferred approach to the development of enrollment projections by attendance area would be one based on correlation analysis. The task of compiling available demographic data thereby takes on added significance.

V. PROJECT ACTIVITIES

Principal activities of the proposed project would include the following:

1. Definition of overall objectives
2. Inventory of data
3. Definition of data requirements
4. Collection of additional needed data
5. Inventory of methodology theory and software
6. Definition of methodology requirements
7. Definition of model
8. Definition of output reports
9. Development of operable model
10. Development of "User's Manual"
11. Projection of enrollments
12. Documentation and dissemination of results
13. Evaluation and modification

These activities would be followed in subsequent years by on-going evaluation, data up-date and projections based on various user applications of the model.

The sequential arrangement of the major activities listed above are displayed in the first-order project PERT chart, Figure 1. More detailed planning guidelines will be defined as the project evolves.

The project activities which will require the greatest efforts pertain to data and methodology. Although these functions cannot be defined or known at this preliminary state of planning, the overall approach has been conceptualized.

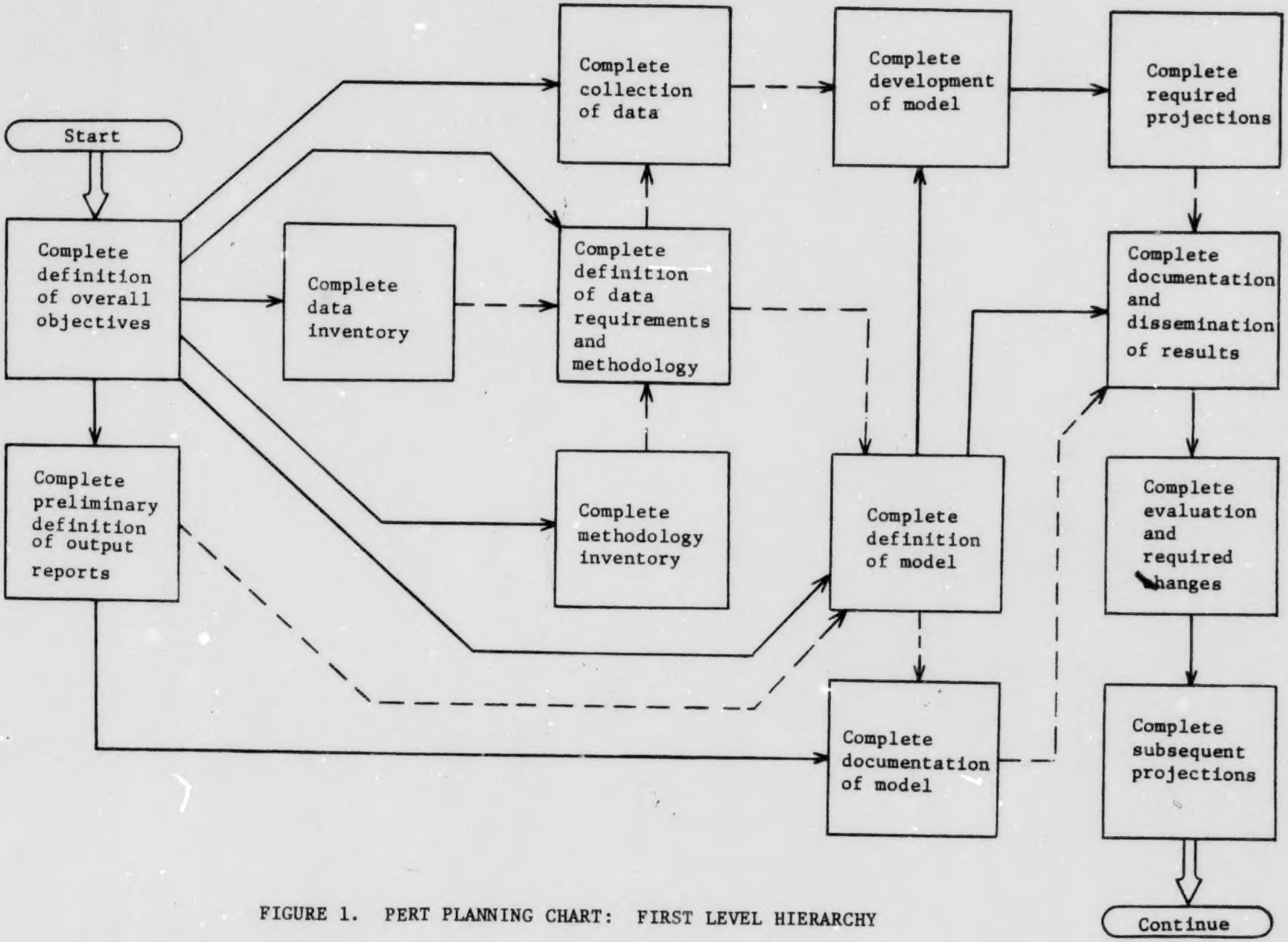
Start
Complete definition of overall objectives
Complete data inventory
Complete collection of data
Complete definition of data requirements and methodology
Complete methodology inventory
Complete preliminary definition of output reports
Complete development of model
Complete definition of model
Complete documentation of model
Complete required projections
Complete documentation and dissemination of results
Complete evaluation and required changes
Complete subsequent projections
Continue

FIGURE 1. PERT PLANNING CHART: FIRST LEVEL HIERARCHY

Data Inventory, Acquisition and Transformation

Data sources in addition to those preliminarily identified in Table 4 will be sought and the task of conducting a data inventory will be carried out. The proposed project does not include the generation of new data as existing data are believed to be sufficient for reliable enrollment projections. The data inventory will include information relative to the following descriptors:

1. Agency name, address, phone and contact
2. File identification code and description
3. Date of collection and up-date frequency
4. Number of records on file
5. Geographic areas:
    a. County/city/township
    b. Public and private school districts, school groupings (elementary, junior high, senior high, community college) and attendance centers
    c. Census tracts
    d. Enumeration districts and block groupings
    e. Blocks
    f. Origin-destination zones
    g. Zip zones
    h. Political districts (congressional, ward, precinct)
6. Accuracy
7. Controls
8. Data source
9. Historical maintenance
10. Availability
    a. Mobility
    b. Cost
    c. Confidentiality
11. File Media
    a. Card
    b. Disk
    c. Magnetic tape
    d. Parity, density, mode
    e. Non-machine readable
12. Availability of format and media user's guide

Because the geographic areas listed in (5) above exhibit extensive overlapping and are generally nonconformal, an extensive degree of data transformation will be required.

Methodology

The projection methodology will relate past socioeconomic statistics such as population, land use, births, deaths and migration in an interactive computerized model that will allow community judgment inputs to make forecasts and distributions.

The fitting and testing or "calibration" of the model will make extensive use of multiple regression techniques utilizing historical socioeconomic data. These data will be interrelated to define the functional relationships and the significance of these factors on the population distribution trends.

Judgmental factors which deal with futuristic expectations, such as future land uses, will be superimposed as control parameters on the functional interrelationships to provide projections on the basis of "What if...?"

Proposed techniques to be used to assist in this function are listed below:

1. Data linkage and manipulation systems
    a. Map digitization
    b. Address matching
    c. Multicontingency analysis
    d. Computer graphics

2. Regression
    a. Time series
    b. Other independent variables
    c. Combination of (a) and (b)

3. Cohort

4. Cohort/Regression for migration affects

5. Time-Capacity ("S" curves)
    a. Logistics
    b. Gompertz

6. Land use model

VI. PROJECT ORGANIZATION AND SCHEDULE

The proposed project will be conducted by the staff of the Institute for Community College Development (ICCD) of Johnson County Community College. It will be under the general supervision of Dr. Harold L. Finch Dean, Institute for Community College Development. Shawnee Mission Unified School District No. 512 will provide liaison services for the purpose of identifying project goals.

The primary technical effort will be provided by existing ICCD staff supplemented by three specialists in the area of urban planning. The short-range nature of the proposed project and the required skills and expertise unique to this one-time effort make it necessary to employ outside specialists in lieu of hiring full-time personnel. Brief resumes of the non-JCCC project staff are included in Appendix C. Personnel and their respective levels of effort follow:

Staff	Effort, Man-Months
Dr. Harold L. Finch	2.3
Dr. Elaine Tatham	5.6
Non-JCCC Urban Planning and Programmer Specialists	4.5
Research Assistant, Clerical and Student Aid	5.5

The preliminary schedule of the major project activities follows:

	Activity	Start	Stop
1.	Definition of overall objectives	2-15	3-1
2.	Inventory of data	3-15	5-1
3.	Definition of data requirements	3-15	5-15
4.	Collection of additional needed data	3-15	6-15
5.	Inventory of methodology theory and software	3-15	5-1
6.	Definition of methodology requirements	3-15	5-15
7.	Definition of model	3-15	5-15
8.	Definition of output reports	3-15	5-15
9.	Development of operable model	5-15	8-15
10.	Development of "User's Manual"	5-15	10-15
11.	Projection of enrollments	8-15	9-15
12.	Documentation and dissemination of results	8-15	10-15

VII. PROJECT BUDGET

Funds required to carry out the proposed project will be derived from two 1971-72 budget sources: (1) Shawnee Mission School District special authorization and (2) ICCD "Projects" account (16-10-04). A summary of estimated expenditures and revenue follows.

Expenditures (excluding existing JCCC positions)

Urban Planning and Programmer Specialists	$11,200
Data Processing	4,000
Clerical Overload	1,000
Map Digitization	500
Supplies and Miscellaneous	600
Total	$17,300

Revenue

Shawnee Mission Special Authorization	$11,700
ICCD "Projects" Account	5,600
Total	$17,300

A letter from Dr. Arzell L. Ball, Shawnee Mission Superintendent of Schools, relative to the District's participation in the proposed project follows.

BEST COPY AVAILABLE

JAN 27

SHAWNEE MISSION PUBLIC SCHOOLS
ARZELL L. BALL, SUPERINTENDENT
ADMINISTRATION BUILDING
7820 ANTIOCH
SHAWNEE MISSION, KANSAS 66204
TELEPHONE 913-831-1900

OFFICE OF THE
SUPERINTENDENT

January 26, 1972

Dr. Harold Finch
Johnson County Community College
57th and Merriam Drive'
Shawnee Mission, Kansas 66203

Dear Harold:

Thank you for assisting the administration at the January 24 board meeting. We are sorry that we had such a large audience for you; however, I felt the discussion was excellent and the vote was beyond my wildest imagination. I had not thought about a 7-0 vote in favor of the demographic study. I had hoped for a 5-2 vote.

We are delighted about the board approval and hope you will proceed full speed ahead.

Sincerely,

Arzell L. Ball
Superintendent of Schools

ALB-mr

REFERENCES

1. "Educational Needs Survey of Johnson County 1969," Staff and Citizens' Committee of Johnson County Community College, Shawnee Mission, Kansas, May 1969.
2. Sigler, Jack E., "The Population of the Kansas City Metropolitan Area 1960," Community Studies, Inc., Kansas City, Mo., August 1962.
3. "Final Report of the Comprehensive Needs and Services Survey," The Comprehensive Needs and Services Survey Committee, Kansas City, Mo., June 1971.
4. "The Feasibility of an Entertainment-Sports-Cultural Complex in Johnson County, Kansas," Final Report, Midwest Research Institute, Kansas City, Mo., October 26, 1971.
5. Lins, L. J., "Methodology of Enrollment Projections for Colleges and Universities," American Association of Collegiate Registrars and Admissions Officers, Washington, D. C., 1960.

APPENDIX A

AVAILABLE REPORTS AND DATA

The following reports, data, and maps on a regional basis have been compiled by the Institute for Community College Development at Johnson County Community College preparatory to the proposed program:

1. "State of the Region," Annual Report, Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., January 1971.

2. "Metroplan Census Reports," 1970 U. S. Census Summary Reports from First Count Summary Tapes, available from Metropolitan Planning Commission (ICCD has ten reports summarizing Johnson County population and housing data).

3. "Income, Cost of Living, Expenditures," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., September 1971.

4. "School Enrollments & Estimates 1967-1978," Shawnee Mission School District 512, Shawnee Mission, Kans., May 12, 1971.

5. "Sketch Plan - 1990," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., December 1968.

6. "Regional Plan," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., January 1971.

7. Sigler, Jack E., "The Population of the Kansas City Metropolitan Area 1960," Community Studies, Inc., Kansas City, Mo., August 1962.

8. "The Feasibility of an Entertainment-Sports-Cultural Complex in Johnson County, Kansas," Final Report, Midwest Research Institute, Kansas City, Mo., October 26, 1971.

9. "A Decent Home for All - Housing Action in the Kansas City Metropolitan Region," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., January 1971.

10. "Storm Drainage Study - Kansas City Metropolitan Region," Metropolitan Planning Commision - Kansas City Region, Kansas City, Mo., May 1971.

11. "Economic Resources of the Kansas City Region," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., July 1969.

12. "Water and Sewerage Development Plan - Kansas City Metropolitan Region," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., April 1971.

13. "Final Report of the Comprehensive Needs and Services Survey," The Comprehensive Needs and Services Survey Committee, Kansas City, Mo., June 1971.

14. "Socio-Economic and Housing Characteristics of the Population of Metropolitan Kansas City," Regional Health and Welfare Council, Kansas City, Mo., circa 1962.

15. "Population Projections - Kansas City Metropolitan Region," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., April 1968.

16. "Estimates and Projections 1970 - Kansas City Metropolitan Region," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., March 1970.

17. "Missouri: Its Business and Living Environment," regional studies prepared for Commerce Bankshares, Inc. by Midwest Research Institute, Kansas City, Mo., 1971.

18. "Freeway and Expressway Plan - Kansas City Metropolitan Region," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., October 1970.

19. "Demand for Industrial Land 1968-1990," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., July 1969.

20. "The Supply of Industrial Land: 1970 - Kansas City Metropolitan Region," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., May 1971.

21. "Happiness is a Green Place. Open Space Plan - Parks & Recreation. Preliminary Draft," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., December 1971.

22. "Olathe Neighborhood Analysis," Oblinger - Smith Planning Consultants, Wichita, Kansas, May 1968.

23. "School Boundary Maps," Shawnee Mission School District, Shawnee Mission, Kansas, February 1970, (Elementary, junior high, and senior high boundary line map series).

24. "Kansas City Area Metropolitan Map Series," Geography Division, Bureau of the Census, U. S. Department of Commerce, Washington, D. C., April 1970, (ICCD has complete map set for Johnson County, Kansas).

25. "1970 Census Tracts - Kansas City Region," Metropolitan Planning Commission - Kansas City Region, Kansas City, Mo., May 1969.

26. "The Mathematical Model Development Program - Introduction and Proposed Program," Department of City Planning, Los Angeles, Calif., September 28, 1966.

27. "Research of Existing Land Use Models," Southwestern Pennsylvania Regional Planning Commission, Pittsburgh, Pennsylvania, March 1967.

28. "Empiric Land Use Forecasting Model," Impact Analyses and Final Report, Metropolitan Area Planning Council - Eastern Massachusetts Region, February 1967.

29. "School Attendance Area Analysis System," Research Report No. 1, Department of Civil Engineering, The University of Wisconsin, Madison, Wisconsin, August 2, 1967.

APPENDIX B

AGENCIES CONTACTED

In order to obtain a preliminary assessment of the extent and quality of available demographic and socioeconomic information pertaining to Johnson County, Kansas, the staff of Johnson County Community College has met or corresponded with numerous individuals and agencies including those listed below:

1. Board of County Commissioners, Johnson County, Kansas

   ·Robert R. Davis, Chairman
   ·Victor W. Kearns, Jr.
   ·Rex F. Price

2. Comprehensive Needs and Services Survey Committee

   ·Sam Kahn, Project Director

3. Information Systems Development, Inc.

   ·Jacob Ruf, Executive Vice-President
   ·David Henderson
   ·Forrest E. Weddle

4. Institute for Community Studies

   ·Dr. Paul Bowman, Director
   ·Grenville M. Robbins, Associate Director
   ·Jack E. Sigler, Director, Program in Aging
   ·Julie Edgerton, Senior Research Assistant

5. Johnson County Bankers Association

   ·Executive Committee

6. Johnson County Court House

   ·William A. Baker, Assessor
   ·Ron Paul, Director of Data Processing
   ·________________, Director of Health
   ·________________, Election Commission

7. Johnson County Health, Welfare and Recreation Council, Inc.

   ·Bill Bendure, Director

8. Metropolitan Planning Commission - Kansas City Region (Metroplan)

    - Richard Davis, Acting Executive Director
    - Dale Sherman, Director, Data Systems
    - Gerald Neely, Director, Engineering
    - Richard Cavender
    - James Bowers
    - Norman Holst

9. Mid-America Council of Governments

    - Jack Pichler, Manpower Planner

10. Regional Health and Welfare Council

    - Charles King

11. Shawnee Mission Unified School District No. 512

    - Dr. Arzell Ball, Superintendent
    - Dr. Robert Lorenzen
    - Charles Smith
    - David Westbrook
    - James Zarnowiecki

APPENDIX C

PLANNING SPECIALTY TEAM

The planning team assembled will consist of three key specialists in the areas of urban planning. The specialists and their fields of expertise are:

Mr. Jacob F. Ruf - Urban information systems, statistical techniques

Mr. Forrest E. Weddle - Systems design, software development

Mr. David D. Henderson - Socioeconomic analysis, population forecasts

Messrs. Ruf, Weddle and Henderson are currently with Information Systems Development, Inc. and have worked together since 1966 when they were employed by the Metropolitan Planning Commission - Kansas City Region. Their success in working as a team on various research and planning assignments, has demonstrated the value of the multi-disciplinary approach to urban planning.

Their mutual interest in data systems and demographic studies led to the design and development of GEOPLANS, an information delivery system which integrates and links data items by street address or any other geographic identifier. GEOPLANS has been used by the team to develop a data base for the greater Kansas City area which includes both census data and other data available from local sources. This system will be used extensively to process the data and to calibrate the projection model.

The team's varied planning experience is evidenced by the many products of their work including:

1. Forecasts of population and other socioeconomic variables.
2. Estimates of transit needs in low-income areas in Kansas City.
3. Application of GEOPLANS.

4. Delineation of goals, objectives and evaluation criteria prerequisite to the development of a PPB system for the City-County Office of Aging.

5. Collection and analysis of socioeconomic profile data pertaining to the Model Neighborhood in Kansas City, Kansas.

6. Analysis of community service delivery systems serving the aging in Kansas City and Jackson County.

7. Collection and analysis of profile data pertaining to the Model Neighborhoods in Kansas City, Missouri and Kansas City, Kansas

8. Collection and analysis of data indicative of the socioeconomic status of the aged in Kansas City and Jackson County.

Mr. Ruf, the team leader, has a Master of Science degree and has twelve years experience using automated information system technology in the areas of planning. He has also published widely in the planning area. Selected publications follow:

"Urban Planning Information System, Design, Concepts and Guidelines" Presented to the State and Local Government Seminar IBM, Washington,D.C.

"Information Integration Technology" Presented to the American Institute of Planners 1968 National Conference - Pittsburg, Pennsylvania.

"GEOPLANS-The Kansas City Regional Information System-KCRIS" Presented to the Urban and Regional Information Systems Association National Conference - Los Angeles, California.

"Urban Information System - a Logical Step Towards Efficient Urban Changes" Data Processing for Local Government Seminar - Washington,D.C.

Mr. Ruf serves on Governor Docking's Technical Advisory Committee on Information and Communication Systems and on Governor Hearnes' Advisory Council on Comprehensive Health Planning. Additionally he is an active technical consultant to Mayor Wheeler.

Mr. Henderson has a Master of Arts degree in Economics and has also published widely in the area of planning. Several of his publications are listed below:

"Preliminary Analysis of the Economy - Kansas City Region", Published by Metroplan, 1967

"The Demand for Industrial Land", Published by Metroplan, 1967.

"The Supply of Industrial Land", Published by Metroplan.

"Community Profile, Model Cities Area, Kansas City, Kansas"

Mr. Weddle has eight years experience in the design and development of data processing tools used to assist in the operation and planning areas. Two of his major publications follow:

"Addmatch" User Documentation Manual. A software package designed to assign geographic identifiers to addressed data.

"Urban Information System, Programs and System Documentation, Manual II". Published by City of Independence, Missouri; later used and distributed as a software package by Honeywell.

APPENDIX C.

Sample Proposal (Phase II): Expansion of JCCC's Demographic Planning Model to Accommodate Enrollment Studies of all School Districts of Johnson County

EXPANSION OF JCCC'S DEMOGRAPHIC PLANNING MODEL TO ACCOMMODATE ENROLLMENT STUDIES OF ALL SCHOOL DISTRICTS OF JOHNSON COUNTY

A Prospectus

April 18, 1973

by

Institute for Community/College Development
Johnson County Community College
Overland Park, Kansas 66210

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Background

A computerized enrollment model has been developed by Johnson County Community College in a project jointly funded by the College and the Shawnee Mission School District. It was designed to predict population characteristics and changes in age and sex distribution taking into account both future socio-economic and political factors which could affect birth and death rates, migration patterns, school participation rates and land use. Since its development last fall, it has been leased by a number of community businesses and agencies to facilitate budget, staff and facility planning. Its principal user has been the College and the Shawnee Mission District.

The detailed output provided Shawnee Mission enabled grade by grade analyses of facility adequacy and assisted the Shawnee Mission staff and board in the optimization of the process of boundary changes (see letter from Superintendent Ball on the following page) as well as to gain an understanding of long-range enrollment patterns. A summary of population changes for the period 1970-2000 for ages equivalent to kindergarten through sophomore is shown graphically in Figure 1.

Population Projections for "Outlying" Johnson County*

With the exception of the undeveloped portions of the Shawnee Mission School District, the enrollments in that district will remain relatively stable through the end of the century. However, these established areas will experience alternate periods of growth and decline as indicated by the North and East High School enrollments in Figure 1. To the contrary, enrollments of the five "outlying" school districts will collectively triple by the year 2000. In order to accommodate this growth it is estimated that almost one thousand new teachers and one million square feet of new school construction will be required. The rate of growth will, of course, vary

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* For the purpose of this report, "outlying" is defined to include those portions of Johnson County not included in the Shawnee Mission School District.

FEB 16 1973

SHAWNEE MISSION PUBLIC SCHOOLS
ARZELL L. BALL, SUPERINTENDENT
ADMINISTRATION BUILDING
7235 ANTIOCH
SHAWNEE MISSION, KANSAS 66204
TELEPHONE 913-831-1900

OFFICE OF THE
SUPERINTENDENT

February 14, 1973

Dr. Harold L. Finch
Executive Dean
Johnson County Community College
111th & Quivira Road
Overland Park, Kansas 66210

Dear Harold:

Thank you very much for the "quote" in the summer school brochure announcing the Demographic Seminar.

The study is proving to be even more valuable than we thought. Boundary change proposals are made much easier and the data goes a long way toward pacifying parents and patrons involved with the changes. I feel that we have a very valuable research tool and Johnson County is indeed fortunate because of your foresight.

Sincerely,

Arzell L. Ball
Superintendent of Schools

ALB-mr

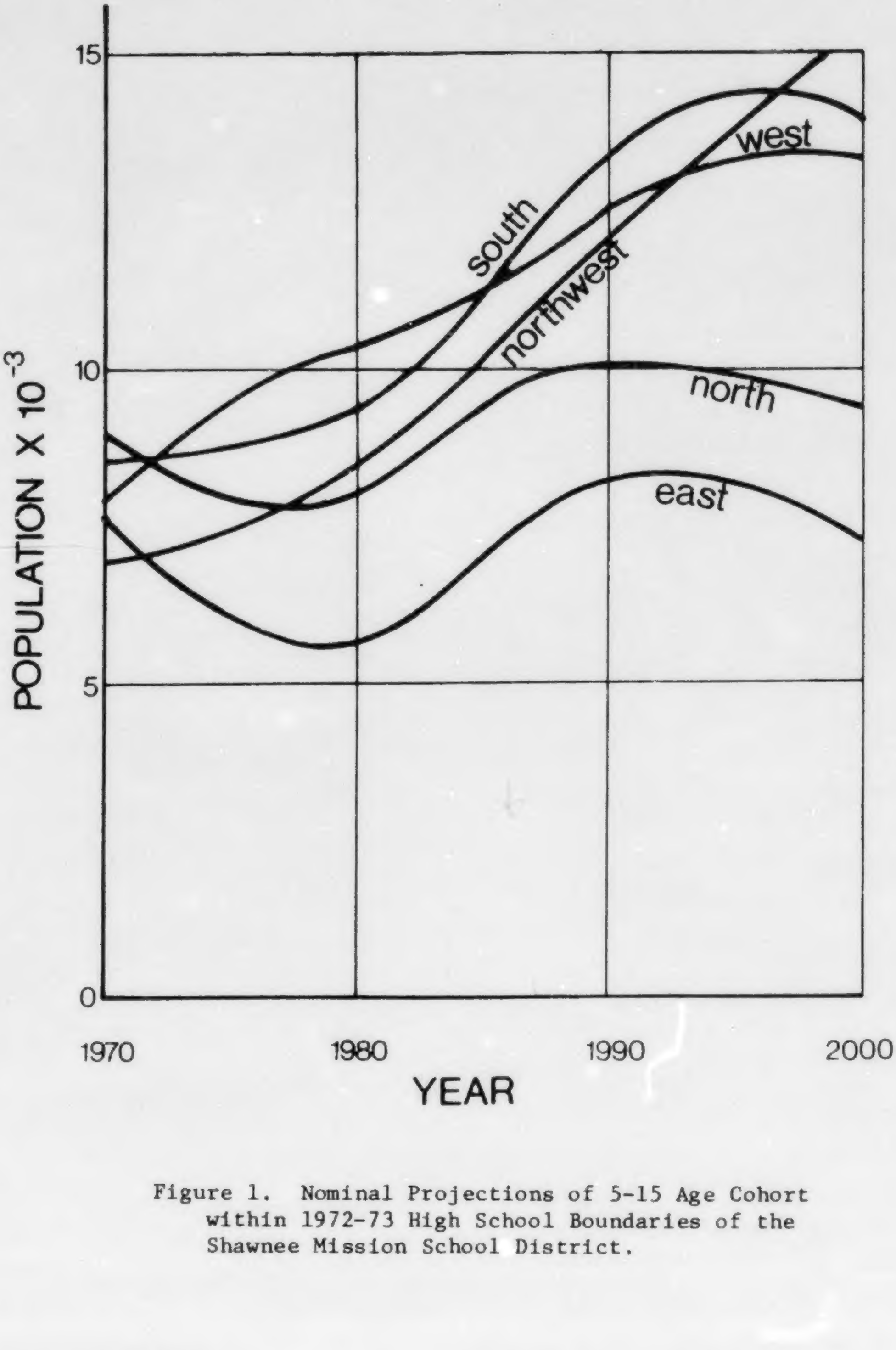

Figure 1. Nominal Projections of 5-15 Age Cohort within 1972-73 High School Boundaries of the Shawnee Mission School District.

considerably between these five districts as well as between areas within these districts. To compound the problem from a planning view point there is considerable evidence that the growth patterns could be significantly different than that intuitively anticipated. Because of the many interacting factors that influence population change (e.g., fertility rates, actuarial data, land development, migration rates and economic and educational factors), only a high speed computer properly programmed can develop meaningful projections that reflect socio-economic and political conditions.

Implications for "Outlying" School Districts

Based on todays economy, annual staffing costs and school construction costs by the year 2000 would have increased by about 7 to 20 million dollars respectively. Therefore a small improvement in long-range planning can result in substantial savings. It is anticipated that the College's computerized enrollment model tailored to the other five school districts would provide significant improvement in planning over methods generally used by the school districts. The annual census method provides information that can be useful in projecting next years enrollments in relatively stable districts. However, in rapidly growing areas this procedure does not account for the most important factor, net migration. This can be extremely misleading in projecting enrollments three to five years into the future—the lead time required for planning, designing and building new facilities.

Modification of the Model for "Outlying" School Districts

Substantial modifications will be required to expand the data base and methodology to be applicable to the "outlying" portion of Johnson County. Some of the major tasks to be accomplished include developing land attractability factors by subsection, developing methodology and program systems which use attractability factors to distribute and normalize the projected aggregated population, conduct a count of the base-year dwellings and completing population disaggregation for

1970. The effort required to effect the modifications is estimated to be 12.1 man months of senior research staff.

Cost and Schedule for Proposed Work

It is projected that the direct cost will be $25,000. This estimate includes $16,800 for contracted services. The project would be completed within six months after initiation.

Project Staff

The project will be carried out by the three principles who developed the existing model. Other experienced support staff will be used as needed. The project team has extensive experience in the development of computerized models for such agencies as NASA, Midwest Research Institute, the Kansas Master Planning Commission and the Metropolitan Planning Commission.

Dr. Harold L. Finch

Executive Dean, Johnson County Community College; also Project Director, Kansas Master Planning Commission for Postsecondary Education. Author of numerous publications including Aviation Guidelines for the American Association of Community Junior Colleges. Lecturer, International Astronautical Congresses, Warsaw and Madrid. Extensive experience in manpower and population model development.

Dr. Elaine L. Tatham

Professor of Mathematics, Franklin College and University of Hawaii. Currently involved in planning and evaluation as Director of Institutional Research. Abstractor, Journal of Higher Education for Psychological Abstracts. Lecturer, National Science Foundation institute, Chofu, Japan. Wide experience in population projections both in and out of education.

Jacob Ruf

Vice President, Information Systems Development, Inc. Formerly Director of Data Systems, Metropolitan Planning Commission, Kansas City. Specializes in transportation, urban affairs, inter-governmental and health planning. Chief systems analyst for development of comprehensive demographic model. Technical advisor, Information and Communications Systems, State of Kansas.

Expanded resumes are included in Appendix A.

Proposal

It is proposed that the existing demographic model, which was developed at a cost in excess of $30,000 of which Shawnee Mission School District funded $11,700, be expanded to include the remainder of Johnson County. It is further proposed that the five "outlying" school districts collectively provide $10,000 and that Johnson County Community College and other possible supporters contribute $15,000 to the cost of development.

APPENDIX A

Expanded Resumes of Project Staff

February 1, 1973

VITAE

HAROLD L. FINCH

Present Position

Executive Dean
Johnson County Community College
Overland Park, Kansas

Education

University of Kansas (B.S., Engineering, 1956)
Ohio State University (M.S., Engineering, 1961)
University of Kansas (Ed.D., Administration, 1971; Dissertation: Educational and Training Requirements to Meet Projected Labor Force Needs of the State of Kansas to 1985) (Honors)

Previous Positions

Dean, Institute for Community College Development, Johnson County Community College, Shawnee Mission, Kansas, 1969-present
  Duties: Responsible for planning and evaluation of all aspects of College -- for the staff and college-wide for the President and Board of Trustees

Dean of Instruction, Johnson County Community College, Shawnee Mission, Kansas, 1968-69
  Duties: As initial academic dean of new community college, responsible for identifying student and community needs, recruiting a staff, developing the curriculum, and writing educational specifications for the new campus

Dean of Applied Arts, Metropolitan Junior College, Kansas City, Missouri, 1967-68
  Duties: Line position responsible for career-oriented programs including planning and administration

Director, Technical-Vocational Education, Metropolitan Junior College, Kansas City, Missouri, 1966-67
  Duties: Staff position responsible for identifying community employment needs and coordinating vocational development and implementation

Instructor, Metropolitan Junior College District, Kansas City, Missouri, and University of Kansas, five years (part-time)

Principal Engineer and Project Director, Midwest Research Institute, 1961-65
  Duties: Project Director/developer of Apollo spacecraft thermal control analysis procedures for NASA

Commissioned Officer, Research and Advanced Planning, U. S. Air Force, 1959-61

Education Related Activities

Project Director, Kansas Master Planning Commission for Education, 1970-present
  Duties: Developed computerized educational planning model for State of Kansas

Member, Kansas Vocational Advisory Council, 1969-present

School Board Member, Overland Park, Kansas, 1965-69

Lecturer, Kansas Academy of Science

Other

Comprehensive exam and defense of dissertation, both passed with honors

Outstanding Achievement Award, Greater Kansas City Advisory Council for the Deaf, 1971

Selected to author major publication for American Association of Community Junior Colleges

One of 12 U. S. scientists invited to speak at the World Congress of Astronautics, Poland, 1964

Who's Who In The Midwest

American Men of Science

Selected Publications

Finch, H. L. and Anderson, K. E., "Postsecondary Educational Planning to 1985: Final Report and Recommendations," Kansas Master Planning Commission for Education, December 1972

Finch, H. L. and Tatham, E. L., "Demographic Study of Johnson County, Kansas," Johnson County Community College, Overland Park, Kansas, October 1972

Tatham, E. L. and Finch, H. L., "Student Attitude Toward the Audio-Visual-Tutorial Instructional Method," Johnson County Community College, Overland Park, Kansas, June 1972

Finch, Harold L. and Noland, Michael C., "Planning and Development of Vocational Education and Services for the Hearing Impaired," Johnson County Community College, Shawnee Mission, Kansas, April 1971

Finch, Harold L. "Projection: Educational and Training Requirements of the Kansas Economy to 1985," Kansas Master Planning Commission for Education, August 1971

Finch, Harold L., Aviation Guidelines, American Association of Community Junior Colleges, Washington, D. C. 1970

Finch, Harold, and Harris, Norman, "Educational Needs Survey of Johnson County Kansas 1969," Johnson County Community College, Shawnee Mission, Kansas, May 1969

Finch, Harold L., "A Study of Science Pioneers, Inc.: A Look at the Past; A Plan for the Future," Report prepared for Science Pioneers, Inc., Kansas City, Missouri, November 1, 1967

Finch, H. L., Noland, M. C., Brown, R. G., and Chementi, E. T., "Thermal Analysis of the Apollo: A Computer Technique Which Accounts for the Influence of Self-Shadowing," XVIIth International Astronautical Federation Congress, Madrid, Spain, September 1966

Finch, H., Noland, M., and Moeller, C., "Experimental Verification of the Analyses and Computer Programs Concerning Heat Transfer Through Semi-transparent Materials," Air Force Systems Command, Technical Report AFFDL-TR-65-136, Ohio, July 1965

Finch, H. L., Rhodes, B. L., and Krause, A. J., "Effect of Vacuum-UV on Reflectance and Emittance of Solar Reflectors," Third Symposium on Thermophysical Properties, Purdue University, March 22-25, 1965

Personal

Born Kansas City, Kansas, March 18, 1933

Married, Three children

Office: Johnson County Community College
111th and Quivira Road
Overland Park, Kansas 66210

Home: 9710 West 104th Terrace
Overland Park, Kansas 66212

February 1, 1973

VITAE

ELAINE LAVALLE JOHNSON TATHAM

Present Position

Director of Institutional Research, Executive Branch
Johnson County Community College
Overland Park, Kansas

Education

Carleton College, Minnesota (B.A., Mathematics, 1958)

University of Kansas (M.A., Mathematics, 1960)

University of Kansas (Ed.D., Educational Research and Measurement, 1971; Dissertation: Gains in Achievement for Children with Learning Disabilities Clustered Via the Distance Measure D)

Previous Positions

Ottawa University, Ottawa, Kansas
Part-time, Mathematics Dept., 1966-69

Franklin College, Franklin, Indiana
Assistant Professor of mathematics, 1964-66
NSF Institute for junior high mathematics teachers (Summer 1966)

University of Hawaii, Honolulu, Hawaii
Instructor of mathematics, 1960-64
NSF Institute for secondary mathematics and science teachers of U.S. children in the Far East, Chofu, Japan (Summer 1964)
College of General Studies evening courses
Refresher course for Federal Aviation personnel (1963)
Civil engineers-in-training review course (1964)
NSF junior science apprenticeship program (Summer 1962, 1963)

University of Kansas, Lawrence, Kansas
Assistant instructor of mathematics (1958-60)

Professional Organizations

American Educational Research Association

Mathematical Association of America

Pi Lambda Theta (educational honorary)

Speaker

Hawaii Science Fair (1961)

Visiting MAA lecturer to Hawaii high schools (1962-63-64)

Hawaii State Mathematics Conference (1964)

Visiting MAA lecturer to Kansas high schools (spring 1967)

Publications and Papers

Finch, H. L. & Tatham, E. L. Demographic Study of Johnson County, Kansas, Johnson County Community College, Overland Park, Kansas, October 1972

Tatham, E. L. & Finch, H. L. Student Attitude Toward the Audio-Visual-Tutorial Instructional Method, Johnson County Community College, Shawnee Mission, Kansas, June 1972

Tatham, C. B. & Tatham, E. L. A note on the predictive validity of the Cooperative Algebra III. Educational and Psychological Measurements, Summer 1971

Tatham, E. L. & Tatham, C. B. Basic Research Methodology for the Behavorial Sciences, Ottawa University, Ottawa, Kansas, 1970 (mimeo)

Tatham, E. J. Continued fractions. Thirty-first Yearbook: Historical Topics for the Mathematics Classroom, National Council of Teachers of Mathematics, 1969

Other

Abstractor of Journal of Higher Education for Psychological Abstracts

Who's Who of American Women (forthcoming volume)

Personal

Born Minneapolis, Minnesota, July 7, 1936

Married, two children

Office: Executive Branch
Johnson County Community College
111th & Quivira Road
Overland Park, Kansas 66210

Home: 701 N. Walker
Olathe, Kansas 66061

February 1, 1973

VITAE

JACOB F. RUF

Present Position

Executive Vice-President
Information Systems Development, Inc.
Kansas City, Missouri

Education

University of Kansas (B.S. Engineering, 1959)

University of Kansas (M.S. Engineering, 1967)

Previous Positions

Director of Data Systems, Metropolitan Planning Commission, Kansas City Region, 1967-69

Manager of Computer Systems and Operation Research, Black Sivalls & Bryson, Kansas City, Missouri, 1964-67

Research Engineer, Panhandle Eastern Pipe Line Company, Kansas City, Missouri, 1961-64

Professional Organizations

Association for Computing Machinery

American Institute of Chemical Engineers

Urban and Regional Information Systems Association

Missouri Public Health Association

Publications

"Techniques and Application of Computerized Data Files to Transportation Planning, Highway Planning and Urban Planning". Presented to the American Society of Civil Engineers Kansas City Section, February 6, 1968

"Urban Planning Information System, Design, Concepts and Guidelines". Presented to the State and Local Government Seminar IBM, Washington, D.C., February 8, 1968

"A Logical Step Towards Inter-Governmental Cooperation", published by American Institute of Planners Co-Author by Stuart Eurman and Richard F. Davis, March 1968

"Planning Information System". Presented to the American Institute of Planners, Missouri Chapter Annual Meeting, March 14, 1968

"Public Information System as a Public Service". Presented to the LeHigh Valley Data Project Seminar, LeHigh University, Bethlehem, Pa., June 12, 1968

"Information Integration Technology". Presented to the American Institute of Planners, 1968 National Conference, Pittsburg, Pennsylvania, October 14, 1968

"GEOPLANS - The Kansas City Regional Information System-KCRIS". Presented to the Urban and Regional Information Systems Association National Conference, Los Angeles, California, September 1969

"Urban Information System - A Logical Step Towards Efficient Urban Changes". Data Processing for Local Government Seminar, Washington, D.C., June 1970

Other

Member of the Governor's Technical Advisory Committee on Information and Communication Systems, State of Kansas, 1968-present

Member of the Zoning Board of Appeals for the City of Merriam, Kansas 1969-present

Governor's Advisory Council on Comprehensive Health Planning, State of Missouri, March 1, 1972 - March 31, 1973

Personal

Born, Kansas City, Missouri, December 30, 1936

Married, four children

Office: Information Systems Development, Inc.
3430 Broadway
Kansas City, Missouri

Home: 13700 Pflumm
Olathe, Kansas 66061

APPENDIX B

Newspaper Articles

BEST COPY AVAILABLE

Kansas City Star
October 23, 1972

School Study

Sharp Growth Seen for '80s

Johnson County

Although the North and East reas of the Shawnee Mission School District have reached a lateau of growth that may last hrough the 1970s, school faciliies in those areas probably will e needed again through the ast 20 years of this century, a emographic study of the couny reveals.

Dr. Harold Finch, executive ean of the Johnson County ommunity College who led a eam in developing a 9-month tudy of projected population nd socioeconomic changes, aid today that school enrollment throughout the school disrict will experience a sharp inrease beginning about 1980 and nay resemble remarkable rowth similar to the 1950s and 960s.

Finch outlined preliminary reults of the study at a press onference today before its formal presentation to the school istrict's board tonight. The $33,000 study was commissioned ast January with the Shawnee Mission district funding $11,600 f the cost and the community ollege financing the remainder.

Praising the report as "an important beginning and a foundaion for lor[illegible] planning" at he session today were Walter iersteiner, school board presient, and Dr. Arzell L. Ball, superintendent.

Ball said a long-range planing committee, initially consisting of top management from ach of the district's divisions, vill be established to analyze he data and explore the demoraphic study's potential.

"For too long we have had to ely on inaccurate and sparse ata for long-range planning," all said. "The information roduced by the study will help s pinpoint population movements by age and sex so we can determine the most effective future use of existing buildings and probable sites for new structures."

Finch cautioned that population projections, which estimate that West, South and Northwest areas will double in size in the next 30 years, should only be used as a general indicator of school enrollment trends.

"Too many factors could significantly change birth and migration patterns," Finch said. "Birth rates could drop drastically because of liberalized abortion-laws or because of ecological concerns.

"On the other hand, the rates could suddenly increase if the birth control pill, for example, is found to have adverse side effects. Birth rates can also be affected by economic conditions and international relations," Finch said.

Assuming no drastic changes in birth rates or the migration in or out of the school district, the report suggests that 60,000 children of the 5 to 15 age group would live in the district by the year 2000.

"This is approximately a 50 per cent increase over the present enrollment of 44,000 students," Ball said.

"We don't know for certain what birth and migration patterns will develop," Ball said. "But we are not stuck with a single report that ignores them. The fact that we can add new data and continually update this study makes it a working tool that never outgrows its immediacy."

An indication that the North and East areas, the older and more stabilized regions of the school district, will experience an upsurge of growth again in the 1980s counteracts a commonly held view among patrons, Ball said.

Finch said the renewed growth beginning in 1980 would be largely due to another bumper crop of babies, "a third generation effect of the post-World War II baby boom."

The enrollment decline in the North and East areas through the next 10 years, however, would be counteracted by steadily rising enrollments in the school district's new areas (the South, West and Northwest), Finch said.

Finch said the validity of the projection was tested at the request of the school district and was found to be remarkably sound and "sensitive."

"We projected 1970 population characteristics on the basis of data available in 1960," Finch said.

"Its accuracy was demonstrated by its ability to forecast a 50 per cent increase to within one per cent of the actual 1970 population," Finch said.

Finch said the study is significant because it brings together more factual information than has been previously available.

"One factor the methodology considers is land-use data," Finch said. "The actions of city councils and the county commissioners in zoning land for industrial or residential purposes, heretofore not used in planning, can grossly affect the number of children and the amount of revenue produced in any one area.

"Before now there was no scientific way of bringing this information together and applying it to the school district's needs," Finch said.

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Study Shows School Facilities Adequate for 5 Years

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By Bill Andersen
A Member of The Star's Staff

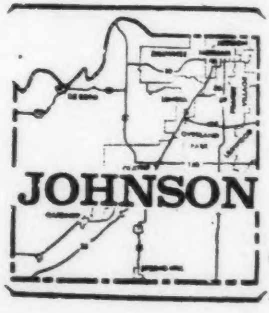
A report that shows continued declining student enrollment rules out a bond issue for the next five years in the Shawnee Mission school district, the district administration said today.

"No bond issues for new schools will be needed for at least five years," Dr. Herbert Bruning, associate superintendent for planning, said today in a report on a demographic study.

The report which will be submitted to the school board tonight is a detailed analysis of a study financed jointly by the school district and the Johnson County Community College.

Original data, submitted to the board last fall, showed only a general decline in student enrollment throughout the 1970s with dips and rises occurring through the year 2000, Bruning said.

"The data clearly indicates that under present conditions we will see a surge in enrollment by 1980," Bruning said.



"Previously this is all the study indicated.

"Now we know that if migration and home-building patterns remain relatively stable, there will be no need for additional buildings within the next five years," Bruning said the administration staff will report tonight at the district's offices, 7235 Antioch, Overland Park.

The five high schools will have some enrollment increases through the 1974-75 academic year and then level off by 1976, the report said. The 10 junior high schools will have increases only through next year (1973-74) and then slight decreases through 1976.

The enrollment hikes in the junior and senior highs can be accommodated by "minor boundary changes for a few junior and senior high schools for 1973-74," Bruning said.

Elementary schools show decreases continuing and changes are anticipated for them, Bruning said.

The report concedes probable "significant increases in enrollment" at five of the 65 schools—Rosehill and Shawanee elementary, Hillcrest and Trailridge junior highs and South Senior High School.

Completion of Oak Park School at 98th and Quivira, the district's 51st grade school, and continued bussing of students from the Rosehill attendance area into Brookridge should take care of pressures on elementary schools there, the report said. Changes in attendance boundary areas for the two junior highs and South High School will accommodate expected increases in those areas. "Current boundaries are being studied and recommendations will be forthcoming to the board," Bruning said.

The demographic study reveals an enrollment decline over the entire district from its 44,028 as of Sept. 15 to 41,027 through the 1975-76 year.

Broken down into the district's five attendance areas, enrollment through the 1975-76 academic year shows a decline in the North area from 8,140 to 7,196; in the East area, a fall from 7,291 to 5,979; in West, a decrease from 10,450 to 9,912; in South, a decline from 9,346 to 9,062 and in the Northwest area a rise from 8,799 to 8,878.

"The scientific data is what has been needed for us to plan effectively rather than our being stampeded into a building program without adequate facts," said Walter Hiersteiner, board president who proposed the demographic study in October, 1971.

Hiersteiner praised the report as a significant scientific tool and praised the co-operation of the community college with the school district as an illustration of a good educational environment in the community.

The $33,000 demographic study was authorized early last year. It was funded with $11,700 in school district funds and the remainder by the college.

It was directed by Dr. Harold Finch, who was dean of the college's development institute and who since has been promoted to executive dean.

"I'm not aware that any other school district can achieve this kind of planning," Bruning said. "Such scientific and sophisticated data for long-range planning allows us to reduce changes in use of school facilities every year and also enables us to make more efficient use of school buildings."

Dr. Arzell Ball, superintendent, hailed the report as illustrating how long-range planning can be meaningful to taxpayers as well as educators.

"At this point we know we won't need a bond issue for at least five years," Ball said. "Just a few years ago we couldn't predict the decline in enrollment we are now experiencing."

"This news should also be gratifying to patrons," the superintendent said, "when it is noticed school taxes declined last year and additional property tax relief may be forthcoming from a new state aid school financing formula."

The school district's operating levy dropped last year to $5.32 on the $100 assessed valuation from a 1971 levy of $5.48.

Forecast of an ability now to handle enrollment the next five years without additional schools contrasts with board members' apparent dilemma a year ago when it was widely believed the district would nave to "bus or build."

Available information at that time indicated a need for new schools in the West and South areas at the same time empty classrooms would be developing in the older and more stable North and East areas.

New schools would require bond issues with the likelihood of negative votes from those patrons in areas where schools were not needed. On the other hand, bussing from the newer areas to older schools would solve the problem but would be an abandonment of the neighborhood-school concept.

"Even with a general decline, enrollment in a few areas of the district will continue to increase," he said. "At various times the board of education will need to decide the best methods of enrollment distributions, consistent with maximum educational benefits and efficient use of facilities.

"At the present time it would appear that with minor changes in enrollment distribution, pupils can be properly housed in current and planned (Oak Park School) facilities through the next five years," Bruning said.

Projections

Projected enrollment fig in the Shawnee Mission Dis through the 1975-76 school reveal the five high schools increase in attendance from current 10,427 to only 10 the 10 junior highs will from 10,899 to 10,324 and elementary school enroll will decline from the pre 22,700 to 20,060.

The breakdown by h schools and their attend areas:

High School Area	Current Enrollment	19 E
North	1,911	
Junior Highs	2,026	
Grade Schools	4,203	
East	1,910	
Junior Highs	1,763	
Grade Schools	3,618	
West	2,286	
Junior Highs	2,531	
Grade Schools	5,633	
South	2,367	
Junior Highs	2,301	
Grade Schools	4,688	
Northwest	1,963	
Junior Highs	2,278	
Grade Schools	4,558	

APPENDIX C

Summary Report to Shawnee Mission School Board

HIGHLIGHTS OF DEMOGRAPHIC STUDY PRESENTATION*

The demographic planning tool developed by the Johnson County Community College in a project jointly funded by the College and Shawnee Mission School District was designed to predict population characteristics within the County taking into account possible future social, economic and political factors which could affect migration patterns as well as birth and death rates. One of the major findings is that student populations in the North and East attendance areas of the Shawnee Mission School District will complete a cycle of decline and growth, while the present West, South and Northwest areas will grow to nearly twice their 1970 size during the next 30 years.

A special benefit afforded by the planning tool is its ability to analyze the scope of unpredictable trends. By considering possible variations the District staff and board will be able to assess the feasibility of various long-range alternatives.

The computerized study breaks Johnson County down into 33 sub areas. These are further subdivided into over 7500 quarter-quarter sections one-sixteenth of a square mile in area. By projecting population data by sex and age at this level of detail, it will be possible to make more knowledgeable decisions regarding boundary lines, staffing requirements and school construction and utilization. The college project staff plans to spend the next few months refining the tool and assisting Shawnee Mission staff members in learning how to apply the model to district studies. After that, the tool will be continually updated in order that it will not outgrow its immediacy.

One of the findings of a "nominal" projection in which present fertility and net county-wide migration rates remain unchanged is that total district enrollment is expected to level off through the 1970's before resuming a sharp increase similar to that of the last two decades. The upsurge beginning in 1980 would be largely due to a bumper crop of babies -- a third generation effect of the post World War II baby boom.

---

* By Dr. Harold L. Finch, Executive Dean, Johnson County Community College, to the Shawnee Mission School District Board on Monday, October 23, 1972.

The current decline in school age children in the East district is projected to drop another 20 percent under "nominal" conditions before the trend is reversed. By contrast, the West area school age population is forecast to increase 20 percent by 1980; however this rate is expected to be exceeded in 1985 by that of the current South attendance area. By 1995 the school age population of the existing Northwest area would have the greatest rate of growth and would become the largest attendance area just before the turn of the century.

However, the "nominal" population projections should only be used as a general indicator of school enrollment trends. There are too many factors that could significantly change birth and migration patterns. Birth rates could drop drastically because of liberalized abortion laws or because of ecological concerns. On the other hand, the rates could suddenly increase if the pill is found to have adverse side affects. Birth rates can also be affected by economic conditions and international relations. These and other "ifs" can be programmed into the model and provide a practical tool for population projection.

By using the current Northwest area which is largely undeveloped and almost half of the entire land in the School District, it was shown how varying the assumptions about fertility rates and migration can alter the projections. If the birth rate declines by 50 percent through the year 2000, and all other factors remain the same, the 5-15 age group increase in the Northwest area would only be 66 percent instead of 125 percent estimated, assuming no change in the current birth rate.

At the request of the School District the College staff tested the validity of the model by projecting 1970 population characteristics based on data available in 1960. The model proved to be sensitive to age and sex distribution changes. Its accuracy was demonstrated by its ability to forecast a 50 percent increase to within one percent of the 1970 population. This provides an indication of the soundness of the methodology and extensive data base and stresses the significance of the user's role in defining realistic "what if" ranges.

The study is significant because it brings together more factual information than has previously been available. One factor the methodology considers is land use data. The actions of city councils and the county commission in zoning land for industrial or residential purposes can grossly affect the number of children and the amount of revenue produced in that area. Before now there was no scientific way of bringing this information together and applying it to the District's needs. This is an important beginning and a foundation upon which long-range planning can be built.

REMARKS PERTINENT TO INTERPRETATION OF ATTACHED GRAPHS*

1. In all cases, the graphs refer to population and are not limited to student enrollment. Projections by school grade will be included in subsequent analysis.

2. In the graphs which portray projections, these computer runs were developed as sample cases. They do provide insight as to future demographic trends and characteristics, but they represent only a limited number of alternatives.

3. The first two graphs provide historic birth rate and net migration trends for Johnson County as a whole.

4. The third graph entitled "Johnson County Females" was made at the request of Shawnee Mission staff to provide a means of evaluating the planning tool's accuracy.

5. The next two graphs entitled "Johnson County Population" show historic and projected population. The data apply to persons residing in Johnson County as a whole. The "nominal" (middle) projection is based on current birth rates and migration trends.

6. The next three charts (vertical bar graphs) provide an indication of growth rate in terms of three basic parameters: birth rates, death rates, net migration. The data apply to 1969-70, all age groups, and areas defined by present Shawnee Mission boundaries.

7. The next two graphs (nominal projections) apply to persons residing within current high school boundaries.

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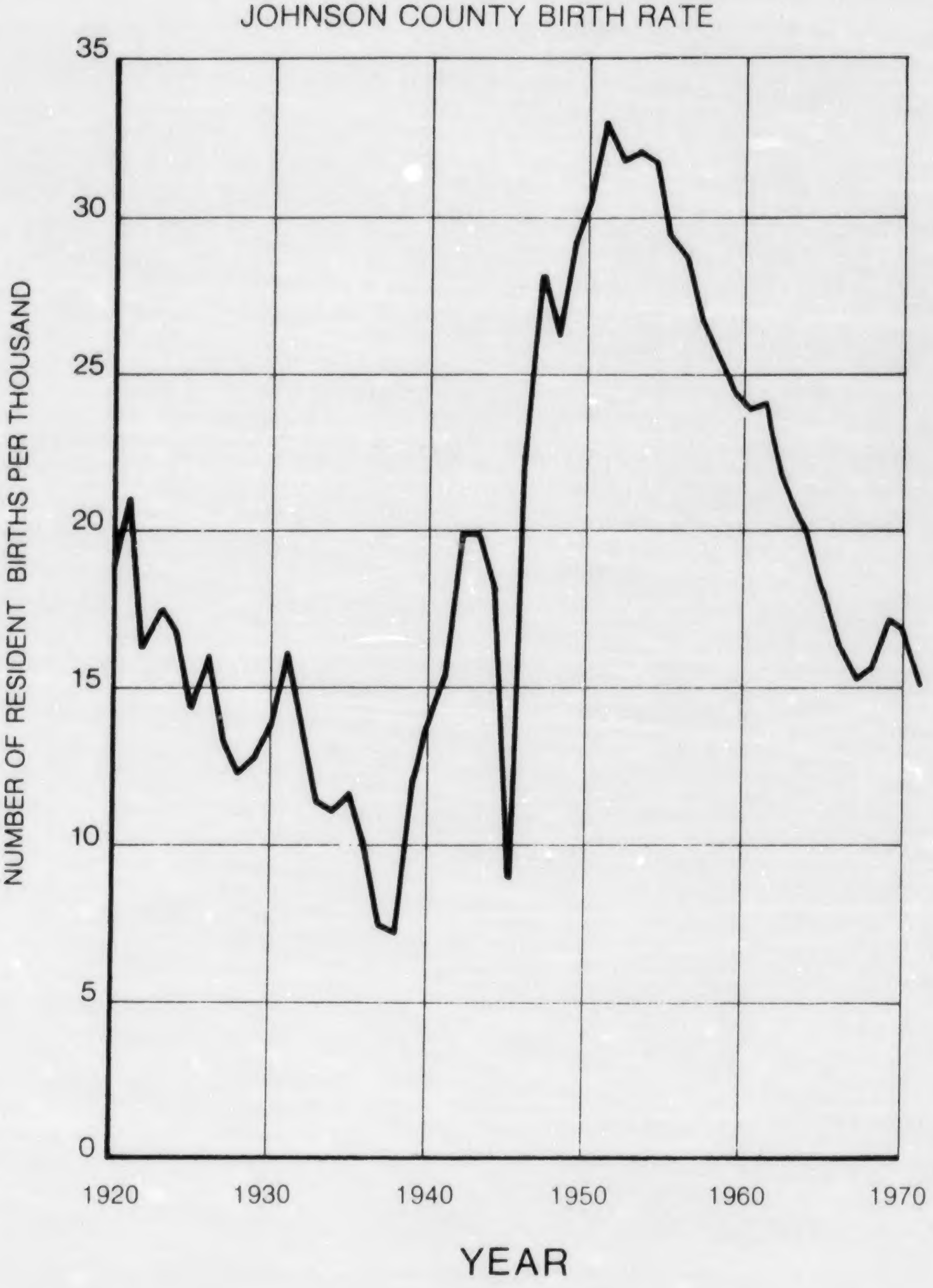
*These comments will be amplified in the College presentation October 23, 1972.


JOHNSON COUNTY BIRTH RATE
35
30
25
20
15
10
5
0
NUMBER OF RESIDENT BIRTHS PER THOUSAND
1920
1930
1940
1950
1960
1970
YEAR

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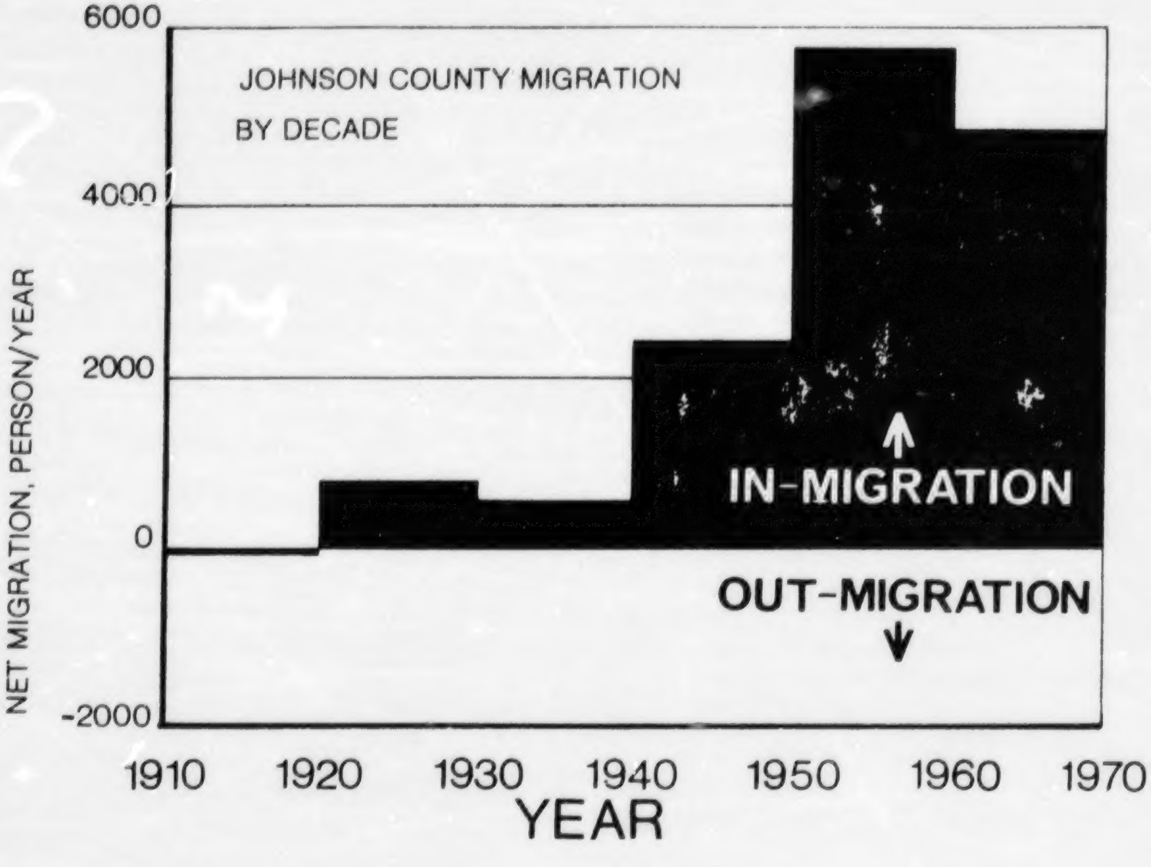
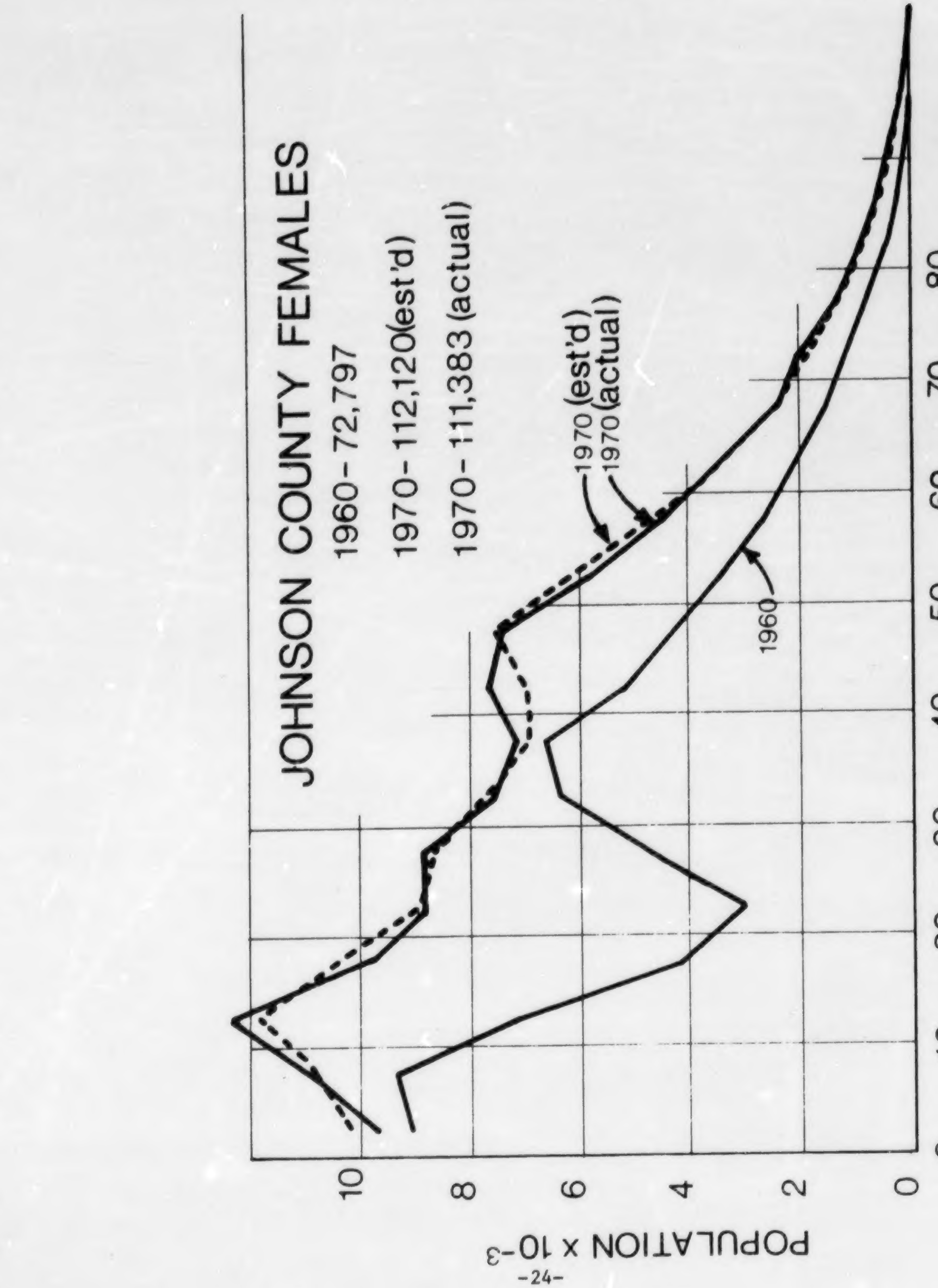
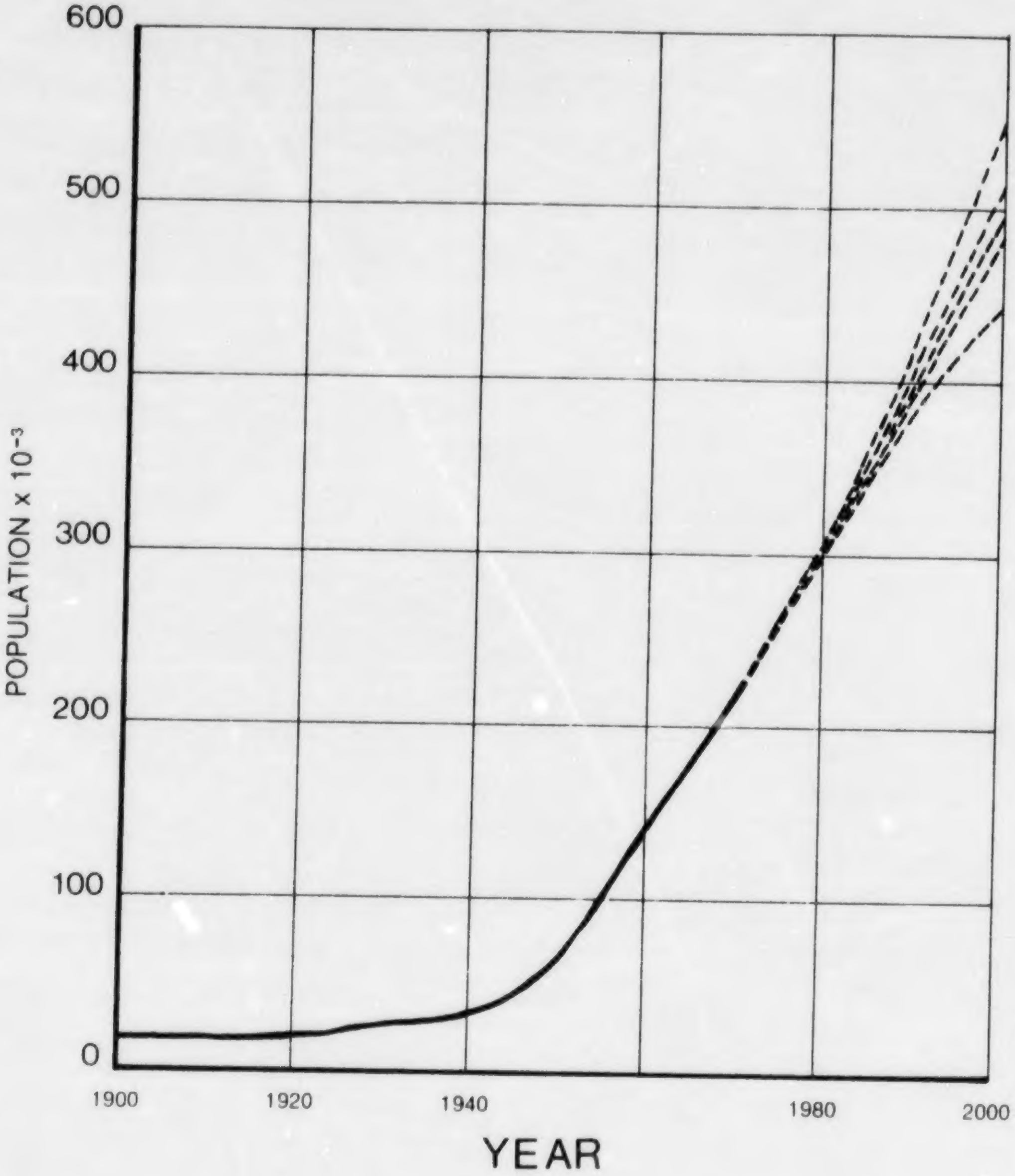


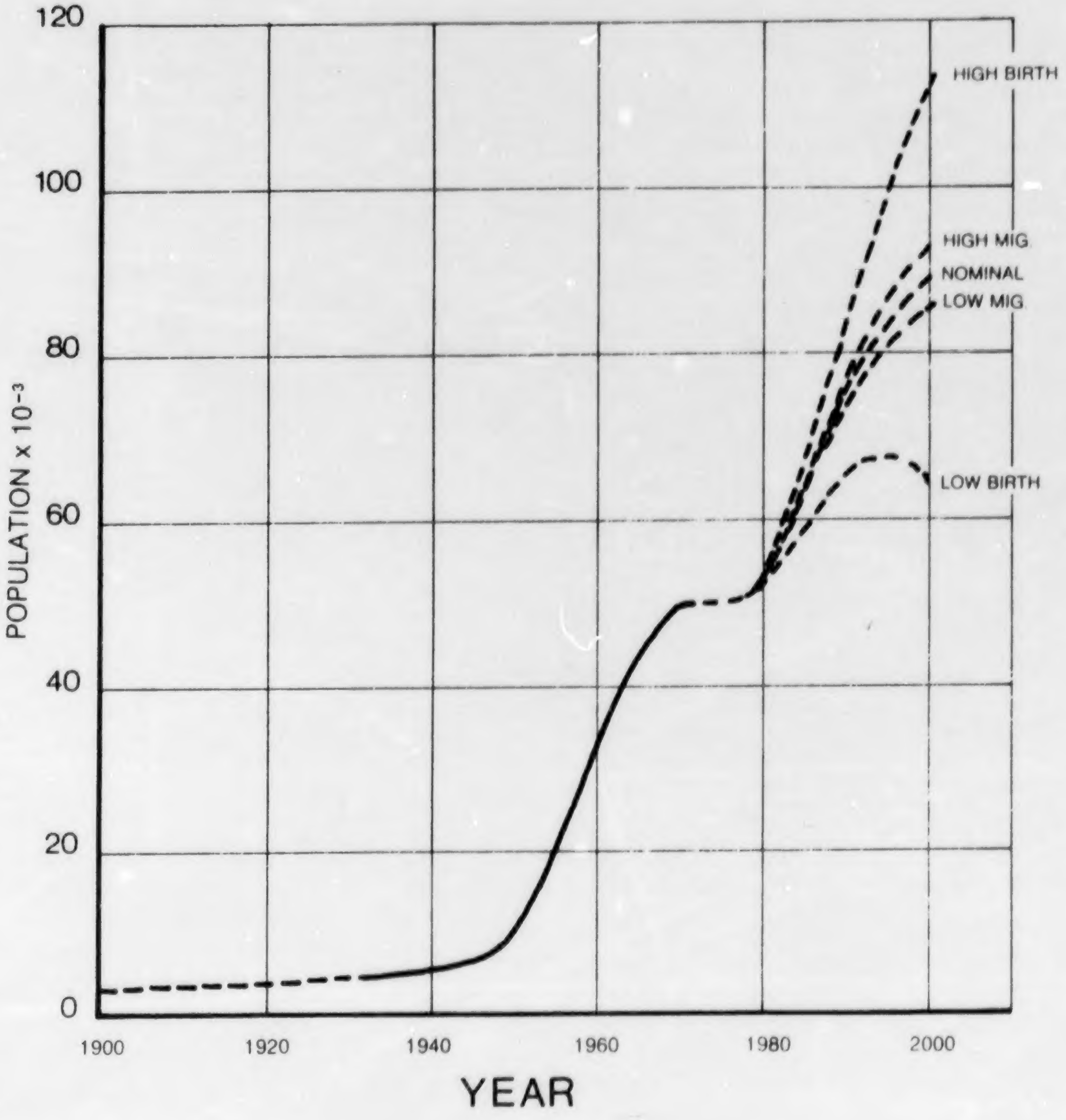

JOHNSON COUNTY FEMALES
1960- 72,797
1970- 112,120(est'd)
1970- 111,383 (actual)
1970 (est'd)
1970 (actual)
1960
POPULATION x 10-3
0
2
4
6
8
10
AGE
0
10
20
30
40
50
60
70
80

JOHNSON COUNTY POPULATION

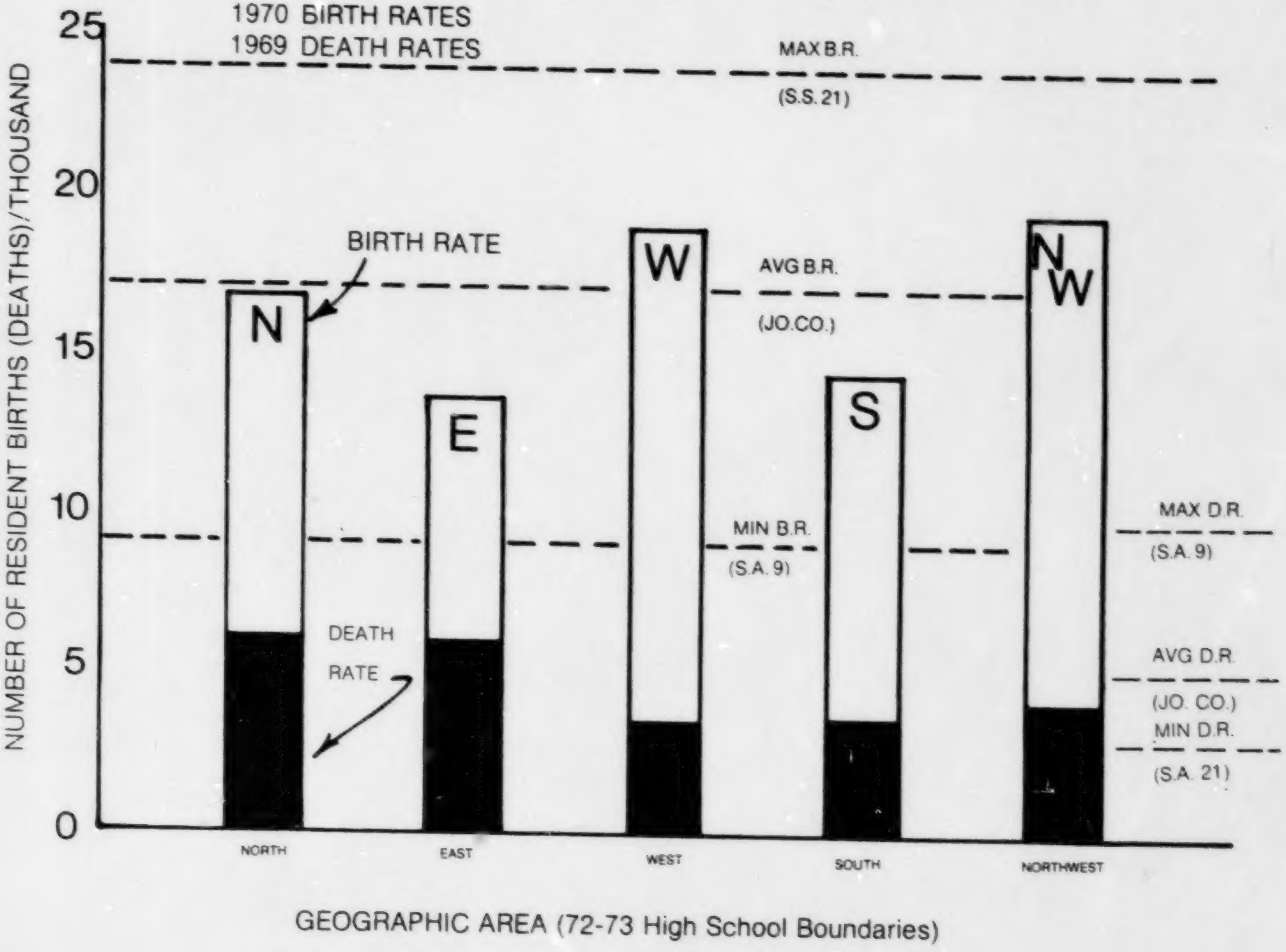
ALL AGES



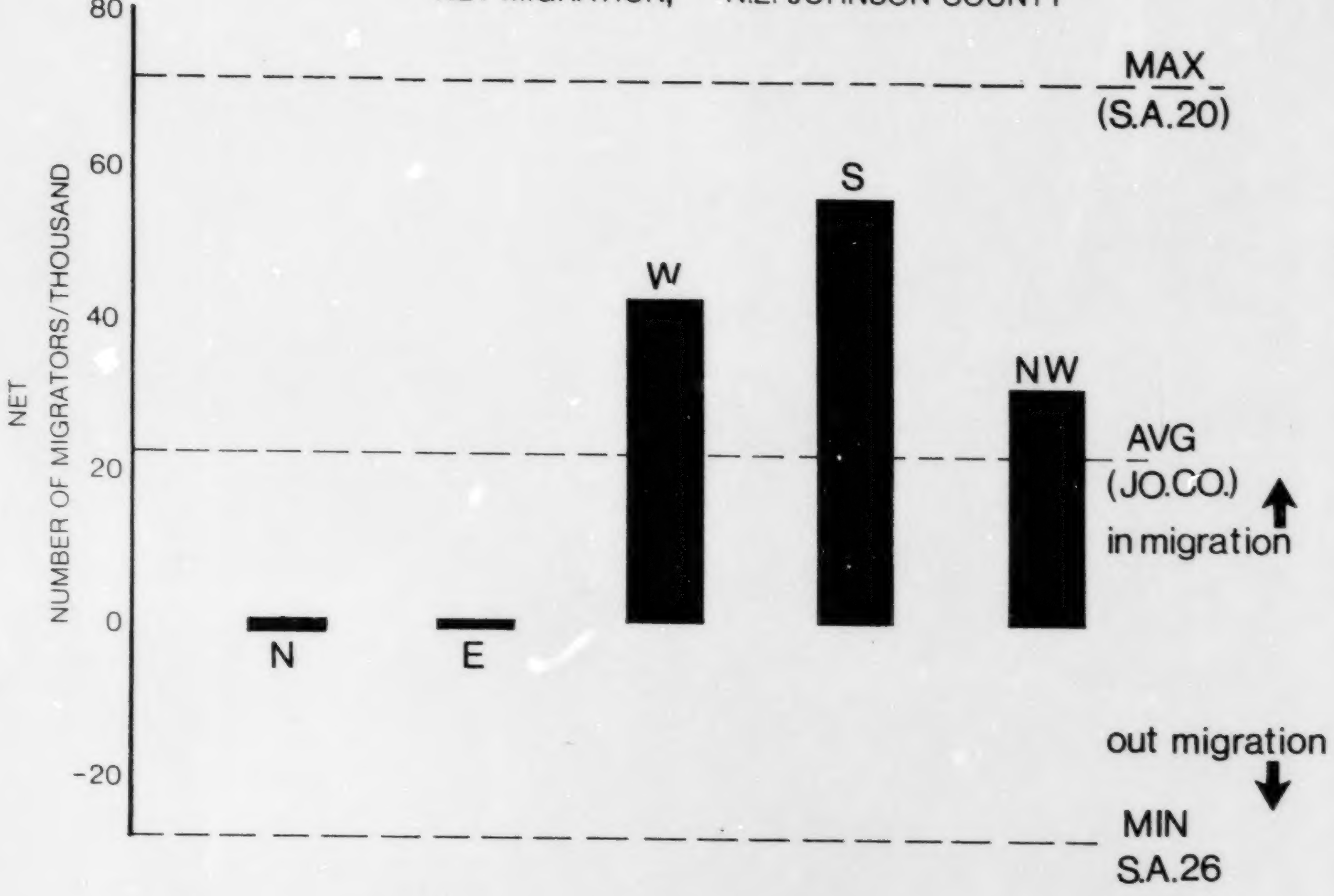
JOHNSON COUNTY POPULATION
5 - 15 AGE COHORT



VITAL STATISTICS N.E. JOHNSON COUNTY



NET MIGRATION, N.E. JOHNSON COUNTY



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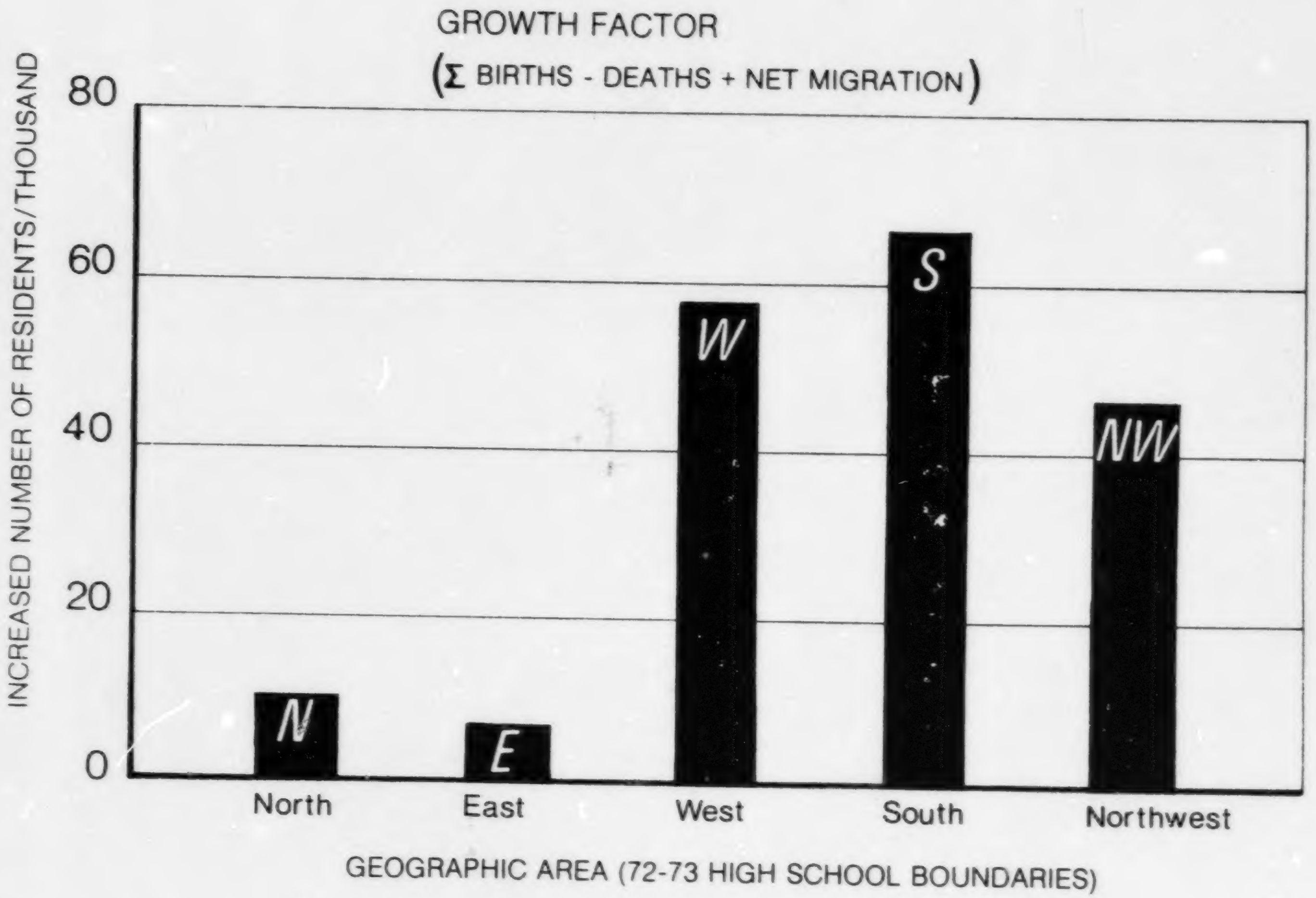


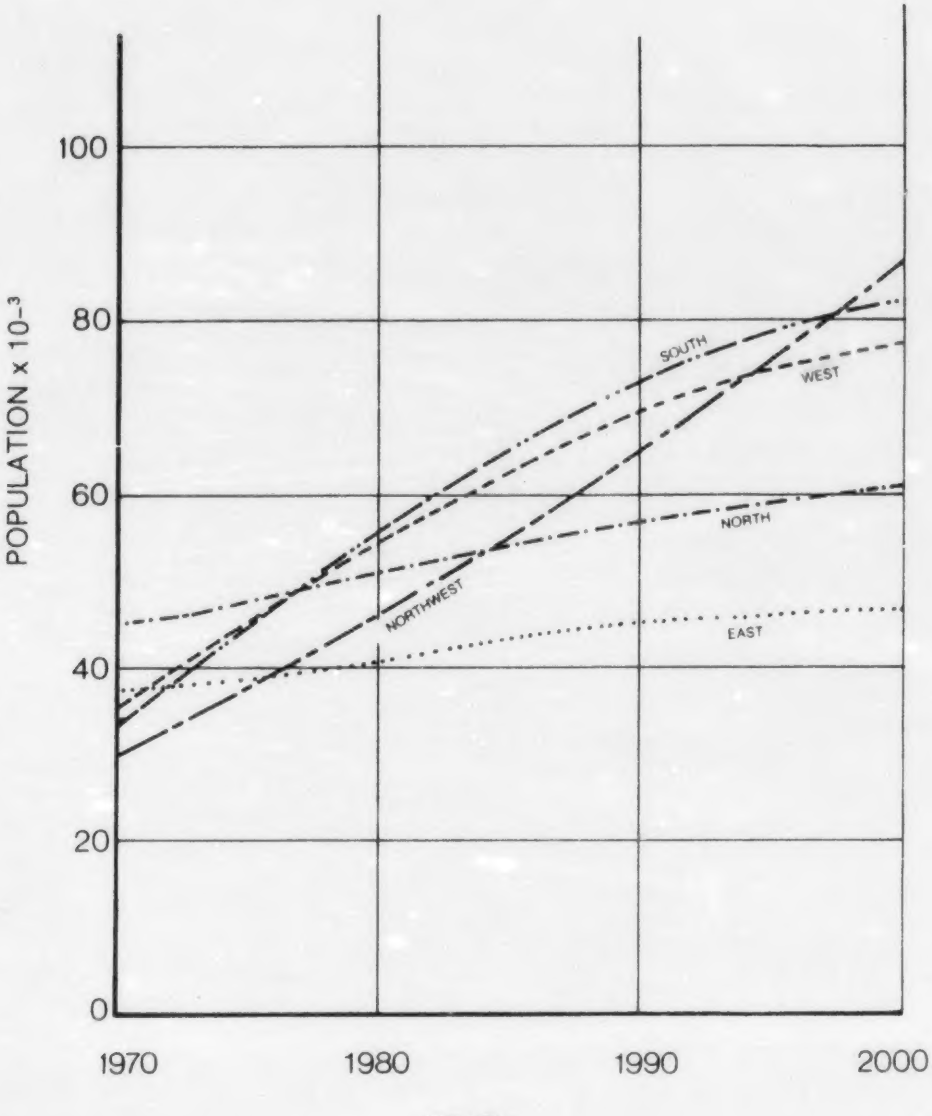
GROWTH FACTOR

(Σ BIRTHS - DEATHS + NET MIGRATION)

NOMINAL PROJECTIONS

ALL AGES

WITHIN 1972-73 BOUNDARIES OF SHAWNEE MISSION HIGH SCHOOL ATTENDANCE CENTERS

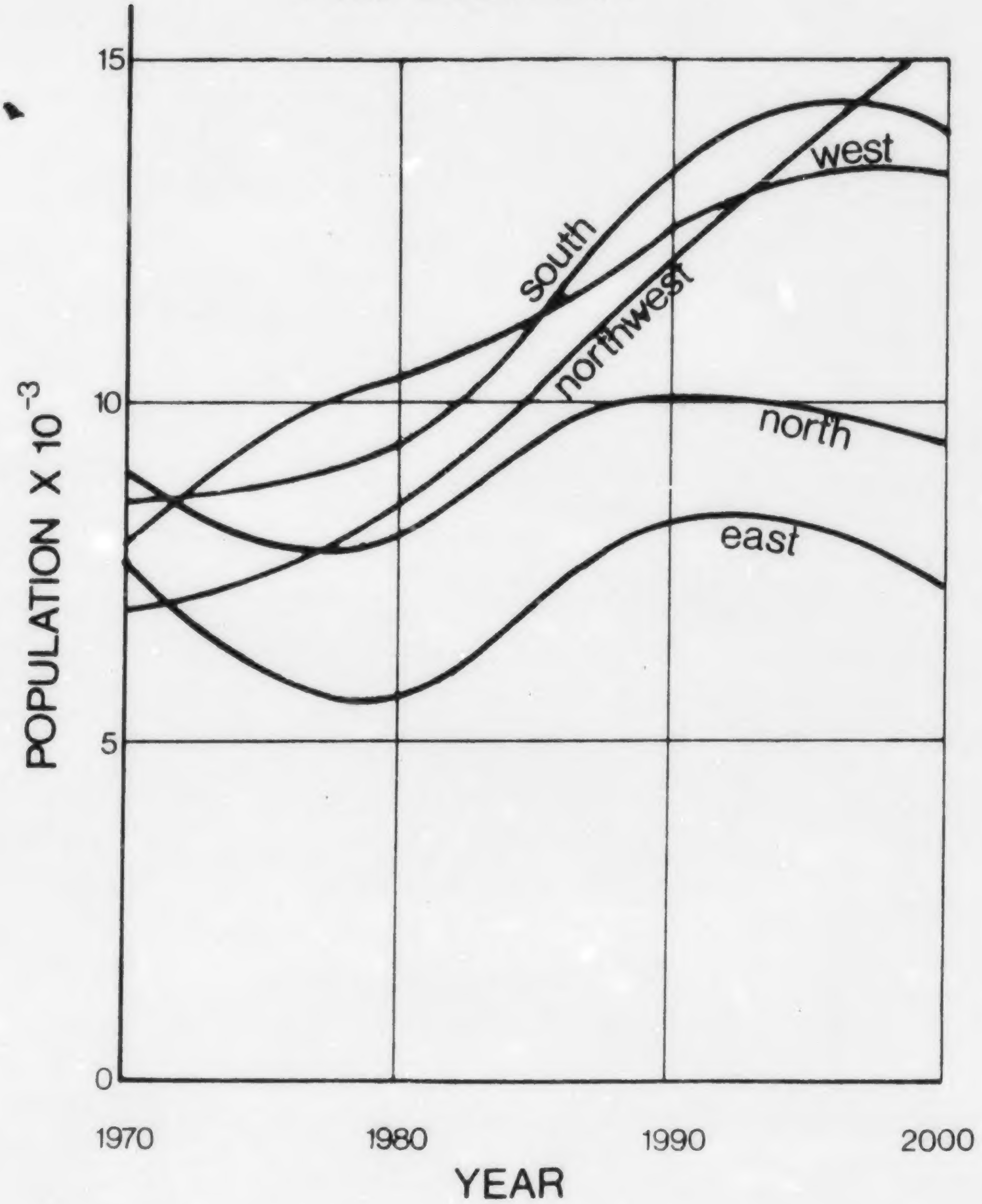


NOMIAL PROJECTIONS

5-15 AGE COHORT

within 1972-73 boundaries of:

S.M. DISTRICT



APPENDIX D.

Sample Study for Church Planners

SAMPLE STUDY FOR CHURCH PLANNERS

Membership Projections
November 1972

The -------- requested the Institute for Community/College Development (ICCD) at Johnson County Community College to project the Church's future membership by families.

The ICCD has spent the last nine months developing a demographic planning tool for Johnson County. The analysis for Johnson County has been done for 33 subareas within the county. For each of these 33 subareas, population projections to the year 2000 has been made by age group and sex. A unique capability of the planning tool allows the user to take into account possible future social, economic and political factors which could affect migration patterns as well as birth and death rates.

The current membership by families of ------ was distributed with respect to the 33 subareas utilized by ICCD in the development of their planning tool. The current membership of the Church has families in 22 of these 33 subareas with 87% of the families living in 2 of these subareas. Seven families live outside of Johnson County.

In order to reduce the task of analyzing an unlimited number of combinations of variables influencing church membership to a representative but manageable size, the most critical variables were isolated and studied. The projections in Tables 1 and 2 were made using the following set of conditions:

1. Current social, zoning, economic, and "church-going" trends and patterns for Johnson County will continue.

2. The number of families living outside of Johnson County will remain constant. Specifically, 7 families will be assumed to live outside Johnson County.

3. The ratio of church families per subarea to total subarea population will remain unchanged to the year 2000. In 1972, for example, 164 families live in the subarea designated as subarea 19. The population in subarea 19 for the year 1972 is 33,895. The specified ratio 164/33,895 = .0048384 was assumed to remain constant. A projected increase in population for a subarea would result in a projected increase in families for that subarea

while a projected decrease in population for that subarea would result in a projected decrease in families for that subarea.

4. The age distribution of the geographic area served by the Church is the same as the age distribution of the population living in the respective subareas.

The accompanying graph and Table 1 indicates that the number of families will increase markedly to the year 1985 growing from 570 families in 1972 to 998 families in 1985. At that time the rate of growth will begin to decline although the number of families can be expected to increase to 1268 by the year 2000.

The percentage age distributions displayed in Table 2 indicate no radical changes in age distribution. However, in the geographic area served by the Church, there will be a gradual increase in the percentage of population over 60. The percentage of those 60 and over will increase from 5% in 1975 to 10.4% in 1990.

FAMILY MEMBERSHIP
Table 1

Year	Number of Families
1972	570
1975	678
1980	847
1985	998
1990	1123
1995	1218
2000	1268

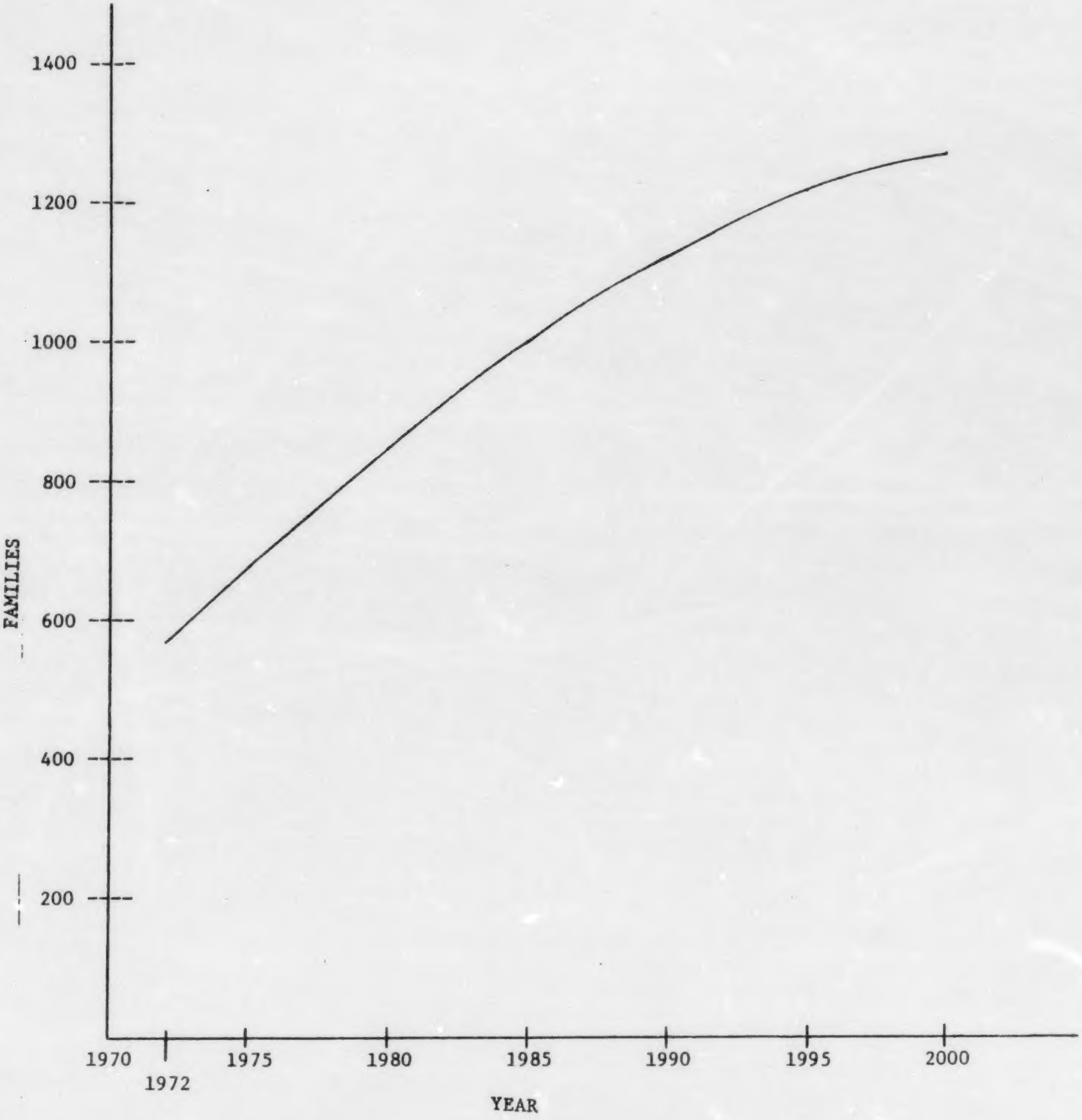
PERCENTAGE AGE DISTRIBUTION OF GEOGRAPHIC AREA SERVED BY

Table 2

Age	1975	1980	1985	1990	1995	2000
0-4	9.6	9.8	10.1	10.1	9.6	9.1
5-9	10.7	9.8	9.6	9.8	9.7	9.2
10-14	11.3	9.6	8.7	8.5	8.6	8.4
15-19	9.8	9.3	8.0	7.2	7.0	7.1
20-24	7.7	8.8	8.5	7.4	6.8	6.7
25-29	6.8	8.4	9.3	9.1	8.2	7.8
30-34	8.8	7.0	8.4	9.2	9.3	8.6
35-39	7.1	7.7	6.2	7.4	8.3	8.4
40-44	6.8	6.2	6.6	5.3	6.3	7.2
45-49	7.2	6.1	5.7	6.0	4.8	5.8
50-54	5.3	6.3	5.4	5.0	5.3	4.4
55-59	3.9	4.5	5.2	4.6	4.4	4.8
60-64	2.0	3.1	3.6	4.4	4.0	3.9
65-69	1.1	1.5	2.4	2.8	3.5	3.3
70-74	0.8	0.8	1.1	1.8	2.2	2.7
75-79	0.5	0.5	0.6	0.7	1.2	1.5
80-85	0.3	0.3	0.3	0.4	0.5	0.8
85+	0.3	0.3	0.3	0.3	0.3	0.3
All Ages	100%	100%	100%	100%	100%	100%

Note: In order to reduce the task of analyzing an unlimited number of combinations of variables influencing church membership to a representative but manageable size, the most critical variables were isolated and studied. The projections in the above tables were based on likely assumptions regarding social, zoning, economic, "church-going" trends and patterns. Further, it was assumed that the ------ will continue to serve the same geographic area.

MEMBERSHIP BY FAMILIES



Note: In order to reduce the task of analyzing an unlimited number of combinations of variables influencing church membership to a representative but manageable size, the most critical variables were isolated and studied. The projections in the above tables were based on likely assumptions regarding social, zoning, economic, "church-going" trends and patterns. Further, it was assumed that the ------ will continue to serve the same geographic area.

APPENDIX E.

Sample Study for Hospital Planners

SAMPLE STUDY FOR HOSPITAL PLANNERS

April 1973

PREFACE

This report was prepared by the Institute for Community/College Development of Johnson County Community College (JCCC) for the ---------- Hospital of Kansas City, Missouri. The findings, which consist of projections of births and children through age 13 for portions of Johnson County for the years 1976-81, 1985 and 1990, were generated by the Institute's computerized demographic planning tool. The tool was developed by JCCC in 1972 to facilitate its long-range planning relative to enrollment, staff, budget, facilities, curriculum and community service. A unique capability of the planning tool allows the user to take into account possible future social, economic and political factors which could affect migration patterns as well as birth and death rates.

ASSUMPTIONS AND RESULTS

Projections of births and children through age 13 for portions of Johnson County are presented in the accompanying table. The geographic zones, which were defined by ---------- Hospital, are based on zip code boundaries.*

Assumptions regarding critical population factors such as future birth rates, death rates and land use were specified as "nominal". That is, current social, zoning, economic and political trends and patterns for Johnson County will continue.

The results were initially generated for 33 standardized areas utilized in the JCCC input/output format. In aggregating the subarea data to zone data, it was assumed that projected populations will be equally distributed geographically within the subarea. For example, if one-half of one subarea was in one zone while the other half of the subarea was in a second zone, the population for that subarea was prorated so that one-half was included in each of the two zones.

---

* ---------- Hospital provided JCCC with a list of the zip codes which correspond to each of the six zone numbers. Zip code 66061 which formed part of zone 10 was not defined with the precision of the other zip codes. The post office at ------ indicated that the geographic area served by them was defined by the rural routes of the postmen rather than by a fixed geographic boundary. A decision was made after conference with ---------- Hospital that zip code 66061 would be defined to include all of Olathe township not included in another zone, the portion of Oxford township not in another zone but west of zone 11, and the portion of Monticello township south of 71st Street.

PROJECTIONS OF BIRTHS AND NUMBER OF CHILDREN BY ZONE NUMBERS WITHIN JOHNSON COUNTY*

Zone	Year	Births	Children Ages 1-13
9	1976	771	10,008
	1977	809	10,278
	1978	846	10,607
	1979	884	10,967
	1980	922	11,383
	1981	964	11,823
	1985	1114	13,865
	1990	1264	16,320
10	1976	564	6,993
	1977	593	7,284
	1978	621	7,610
	1979	648	7,954
	1980	675	8,326
	1981	700	8,703
	1985	789	10,346
	1990	907	12,406
11**	1976	35	470
	1977	37	467
	1978	40	472
	1979	44	482
	1980	47	502
	1981	50	525
	1985	60	668
	1990	66	851
12	1976	974	13,929
	1977	1039	14,308
	1978	1107	14,717
	1979	1174	15,157
	1980	1242	15,635
	1981	1309	16,129
	1985	1530	18,235
	1990	1669	20,664
13	1976	1144	13,176
	1977	1166	13,286
	1978	1187	13,457
	1979	1204	13,669
	1980	1218	13,955
	1981	1229	14,244
	1985	1252	15,560
	1990	1214	16,176

PROJECTIONS OF BIRTHS AND NUMBER OF CHILDREN BY ZONE NUMBERS WITHIN JOHNSON COUNTY*

(Continued)

Zone	Year	Births	Children Ages 1-13
15	1976	632	7,420
	1977	695	7,612
	1978	757	7,880
	1979	816	8,226
	1980	870	8,650
	1981	917	9,130
	1985	1023	11,421
	1990	988	13,375

---

* Each zone number is associated with specified zip codes provided by ----------- Hospital. In order to reduce the task of analyzing an unlimited number of variables influencing numbers of births and children within zones to a representative but manageable size, the most critical variables were isolated and studied. The above projections were based on likely assumptions regarding future social, economic and political factors which could affect migration patterns as well as birth and death rates.

**Further study in this rapidly changing geographic area is anticipated during the summer of 1973. The population estimates obtained from the more detailed study of this area will be available at a later date.

APPENDIX F.

Sample Community Service Report: Historic and Projected Population Data for Johnson County, Kansas

HISTORIC AND PROJECTED POPULATION DATA FOR JOHNSON COUNTY, KANSAS

May 1973

Institute for Community/College Development
Johnson County Community College
111th and Quivira Road
Overland Park, Kansas 66210

PREFACE

In March 1972, Johnson County Community College initiated the development of a computerized demographic planning tool. The primary objective of the project was to facilitate the College's long-range planning capability relative to enrollment, staff, budget, facilities, curriculum and community service.

The principal project staff members were Dr. Harold L. Finch, Executive Dean; Dr. Elaine Tatham, Director of Institutional Research and Jacob Ruf, JCCC consultant. Dr. Finch served as project director and concentrated on the design of the overall model. Dr. Tatham worked on all phases of the project and specialized in theoretical analysis. Mr. Ruf was responsible for software development and integration. Other JCCC participants included Ed Williams and Bob Watkins.

This report was prepared in response to requests for information about the model and its use. It briefly summarizes the demographic modeling capability and presents a sample of data most frequently solicited. Detailed population projections too voluminous to include herein are also available. Additional information concerning the College's demographic capability may be obtained from Dr. Finch or Dr. Tatham by calling 913/888-8500.

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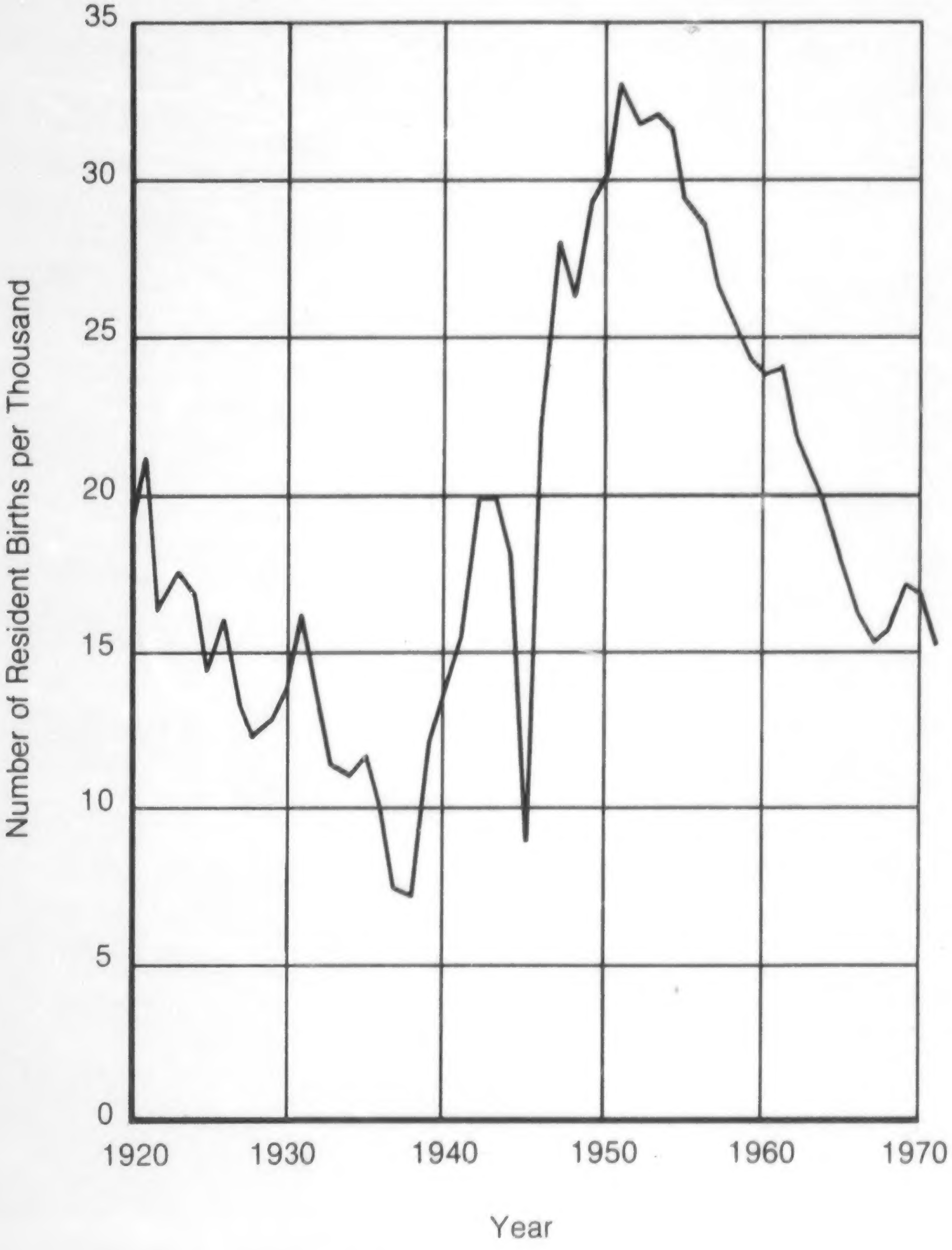
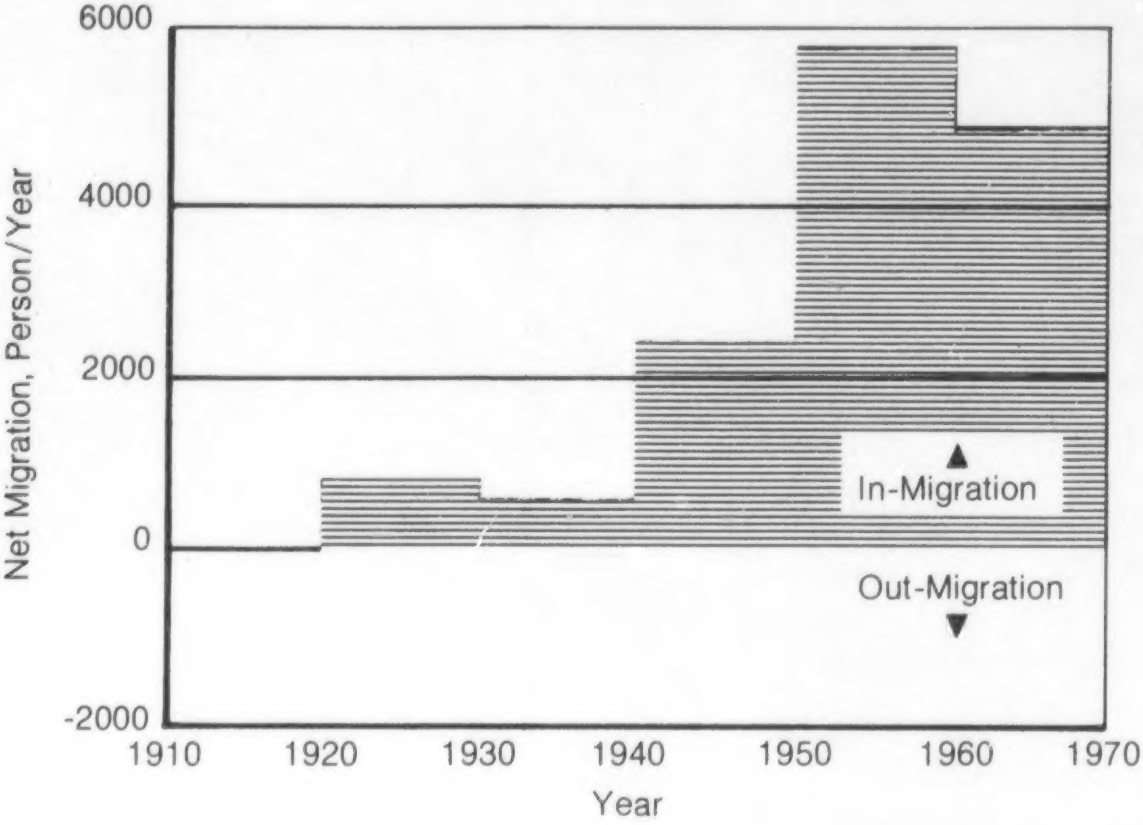
I. HISTORICAL DATA - JOHNSON COUNTY

JOHNSON COUNTY BIRTH RATE

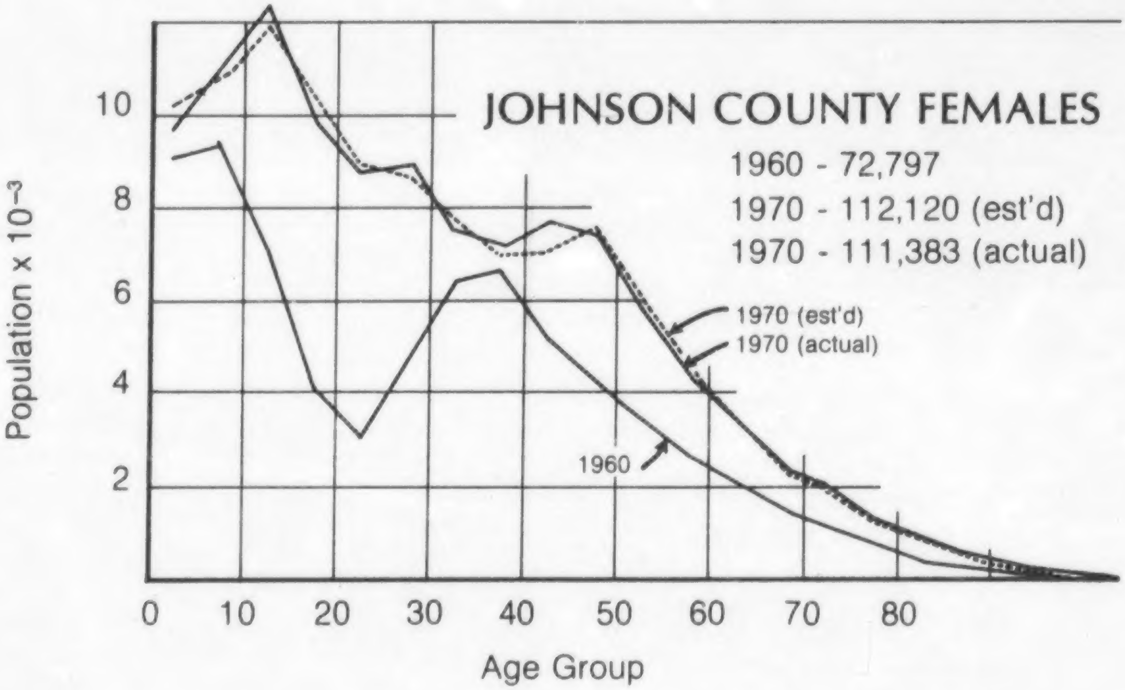


JOHNSON COUNTY MIGRATION
(By Decade)



II. DEMOGRAPHIC PLANNING MODEL TEST CASE

At the request of the Shawnee Mission School District, the College staff tested the demographic planning model by projecting 1970 population characteristics based on data available in 1960. The model proved to be sensitive to age and sex distribution changes, (see graph page 5). Its accuracy was demonstrated by its ability to forecast a 50 percent increase to within one percent of the 1970 population. This provides an indication of the soundness of the methodology and extensive data base and stresses the significance of the user's role in defining realistic "what if" ranges.



Data for five year age groups is plotted at the midpoint. For example, the female population ages 5 - 9 is plotted at age 7.5.

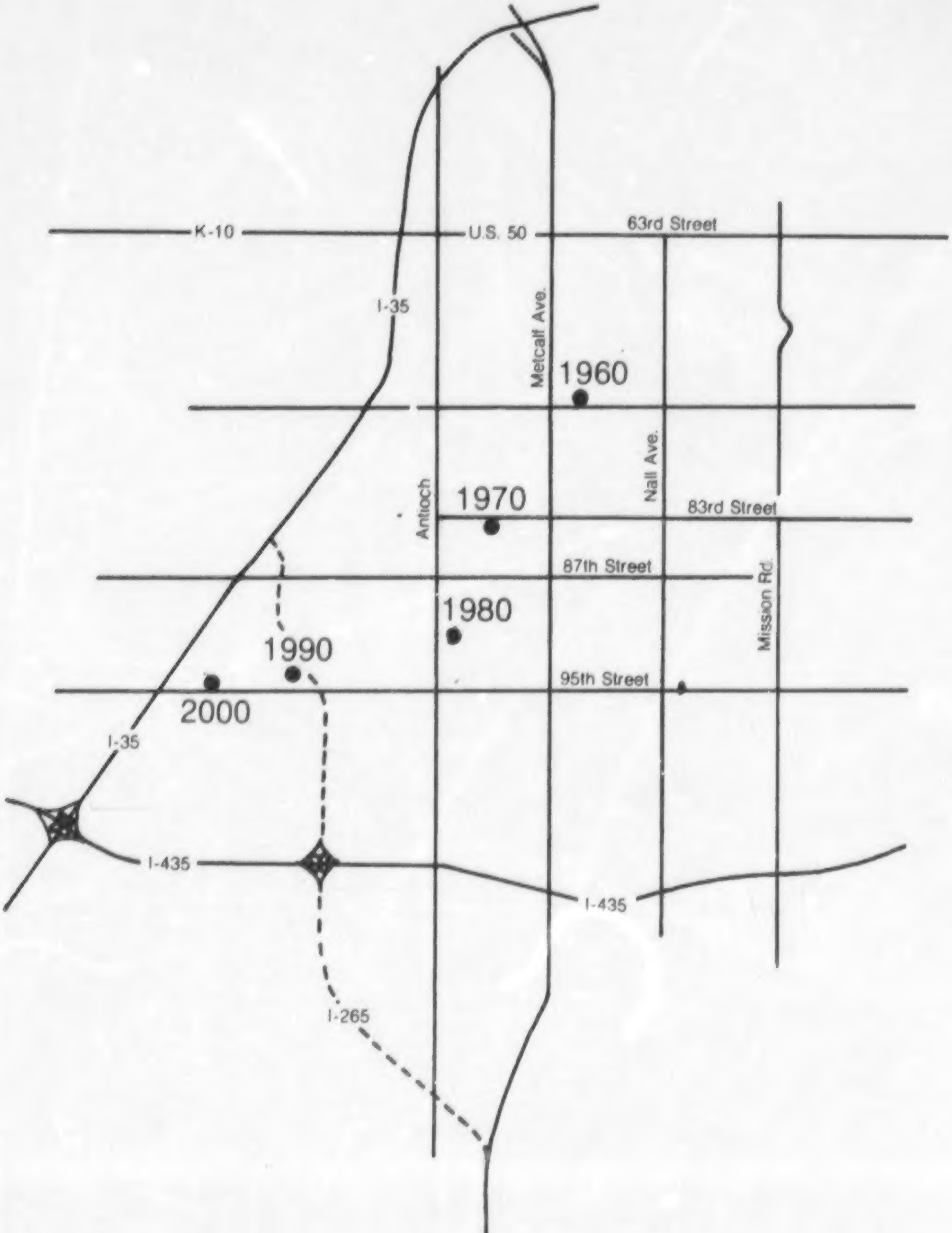
III. JOHNSON COUNTY POPULATION GROWTH PATTERN
1960-2000

Year	Population	Approximate Location of Population Centroid**
1960	143,792	74th and Riggs (about 1/3 mile east of Metcalf)
1970	217,662	83rd and Lowell (about 1/2 mile west of Metcalf)
1980	302,767*	91st and Woodward (about 0.1 mile east of Antioch)
1990	399,748*	93rd and Ballentine (about 0.4 mile west of Switzer)
2000	495,756*	94th and 0.2 mile east of I-35

*In order to reduce the task of analyzing an unlimited number of combinations of variables influencing population growth to a representative but manageable size, the most critical variables were isolated and studied. The projections reported in the table were based on existing social, zoning, economic and political trends and patterns. Alternative projections were made using other values of selected variables.

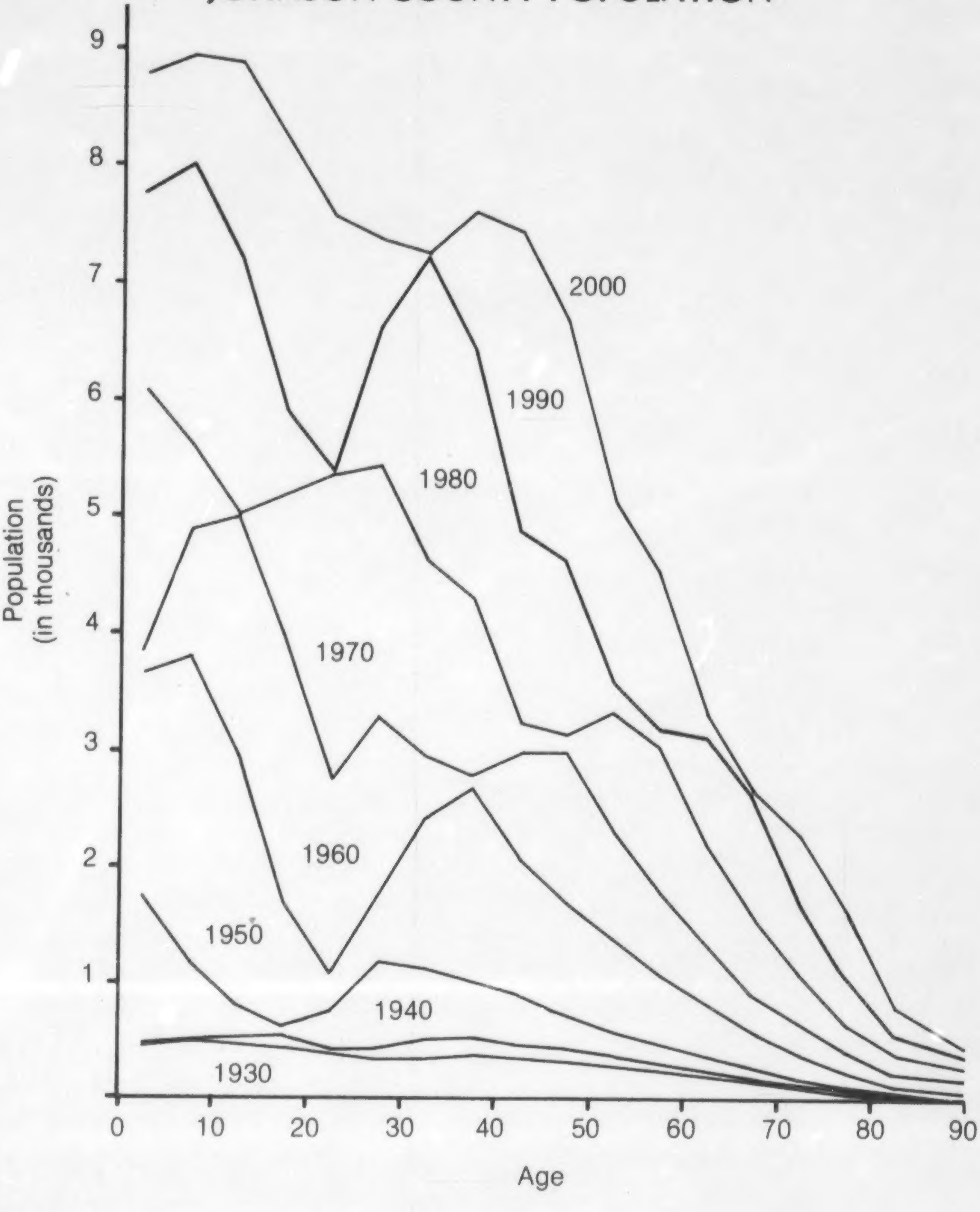
**Population Centroid is defined to be the geographic point in Johnson County where (1) one-half of the population lives north and one-half of the population lives south and (2) one-half of the population lives east and one-half of the population lives west. In 1970, for example, 108,831 lived north of 83rd street and 108,831 lived south of 83rd street while 108,831 lived east of Lowell and 108,831 lived west of Lowell.

JOHNSON COUNTY POPULATION CENTROID

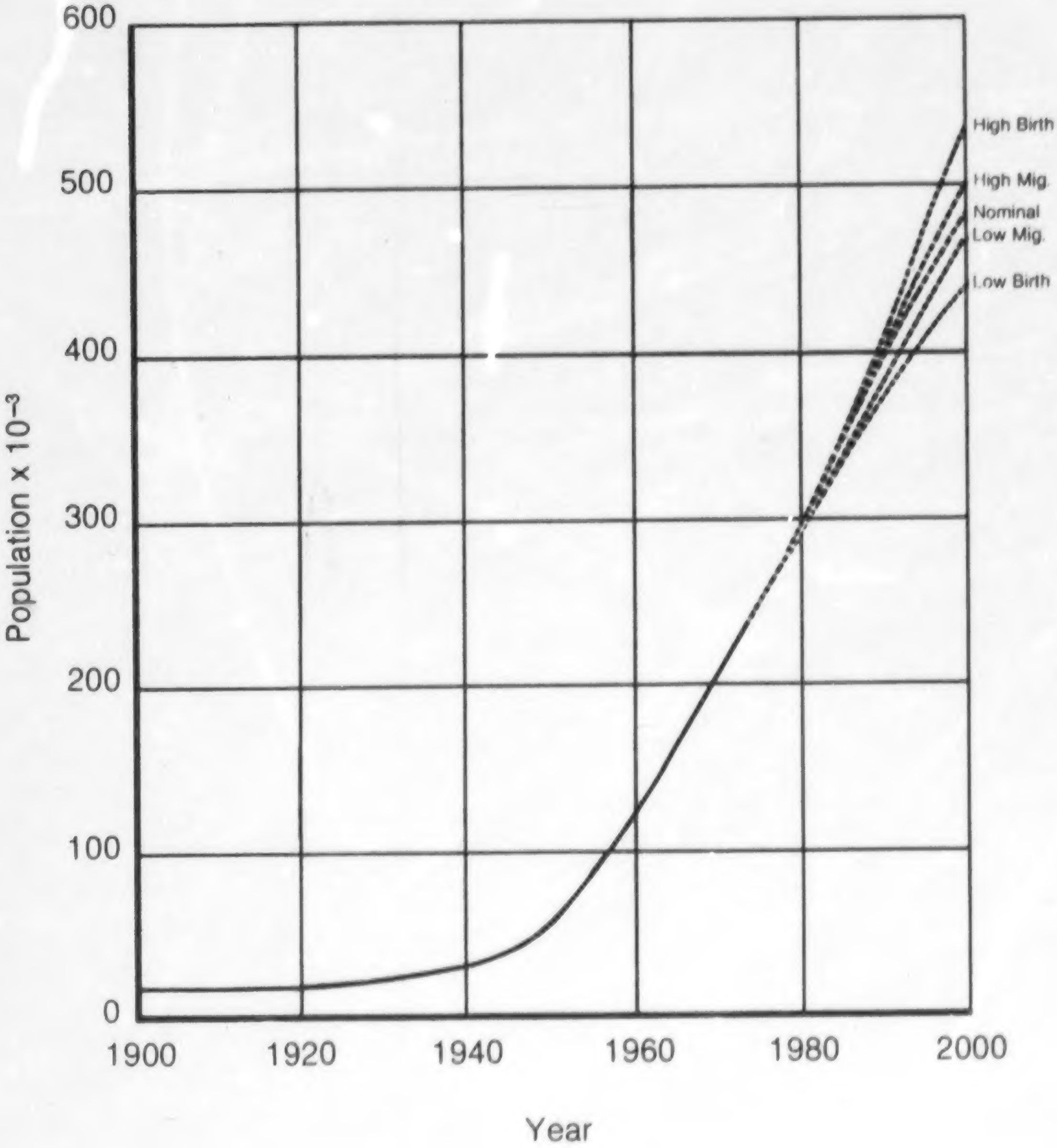

K-10
U.S. 50
63rd Street
I-35
Metcalf Ave.
1960
Nall Ave.
Antioch
1970
83rd Street
87th Street
Mission Rd.
1980
1990
95th Street
2000
I-35
I-435
I-435
I-265

IV. SELECTED JOHNSON COUNTY POPULATION PROJECTIONS

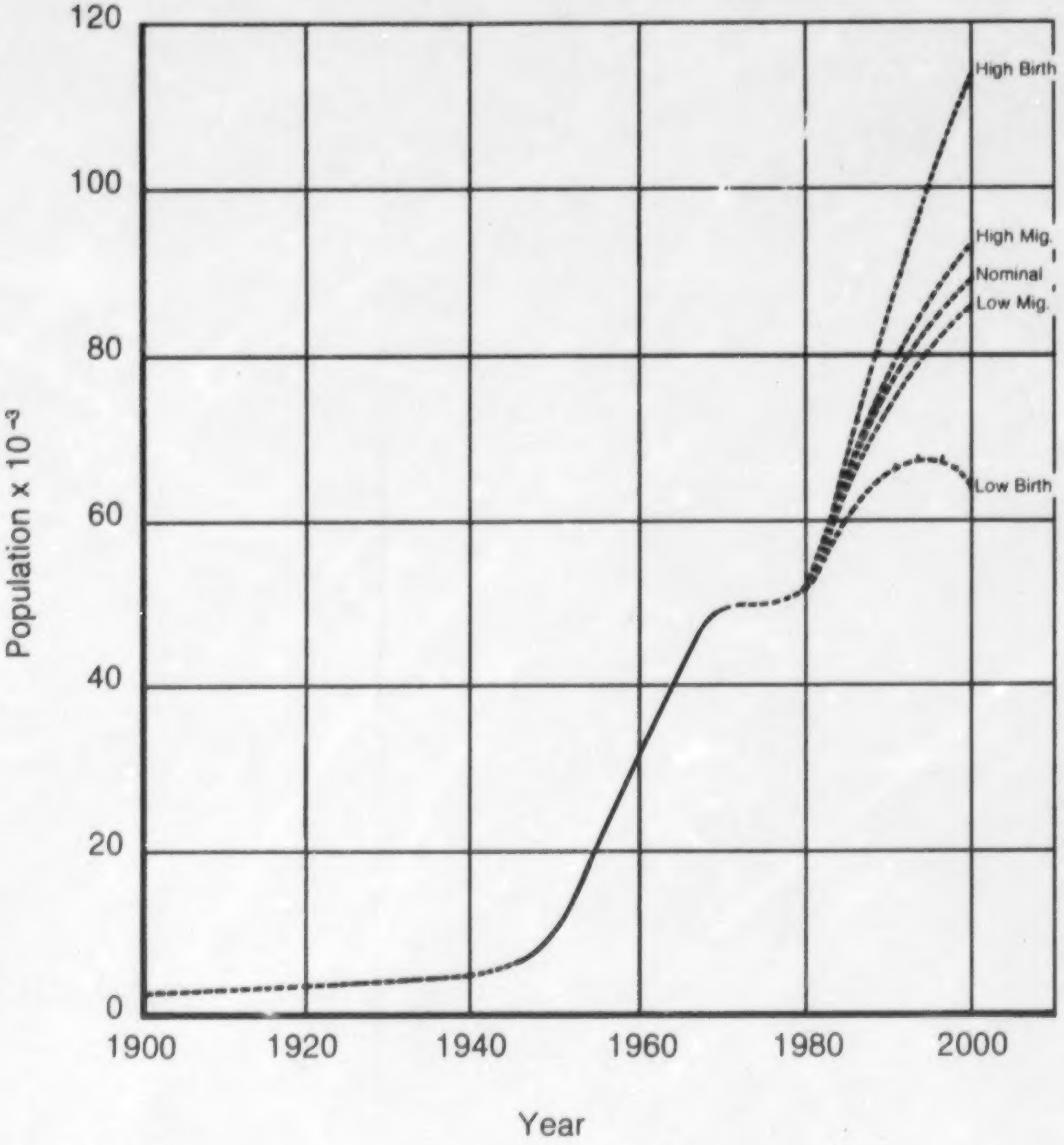
JOHNSON COUNTY POPULATION



JOHNSON COUNTY POPULATION
(All Ages)

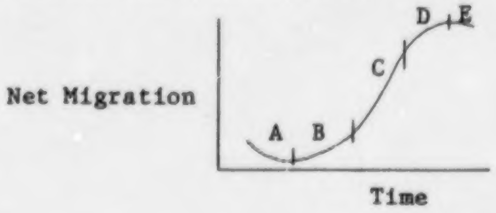


JOHNSON COUNTY POPULATION
(5 - 15 Age Cohort)



V. SELECTED DATA FOR SUBAREA GROUPS

For a fixed geographic area, net migration plotted as a function of time will generally assume the form of an S - curve. Pictorially this is shown below:



The development of land might be described in five stages designated "A" through "E" on the S - curve:

A. Agricultural - undeveloped in terms of potential population capacity. During this stage there is a net out-migration typical of most rural areas today.

B. Initial transition from rural to urban/suburban accompanied by a shift from out-migration to in-migration.

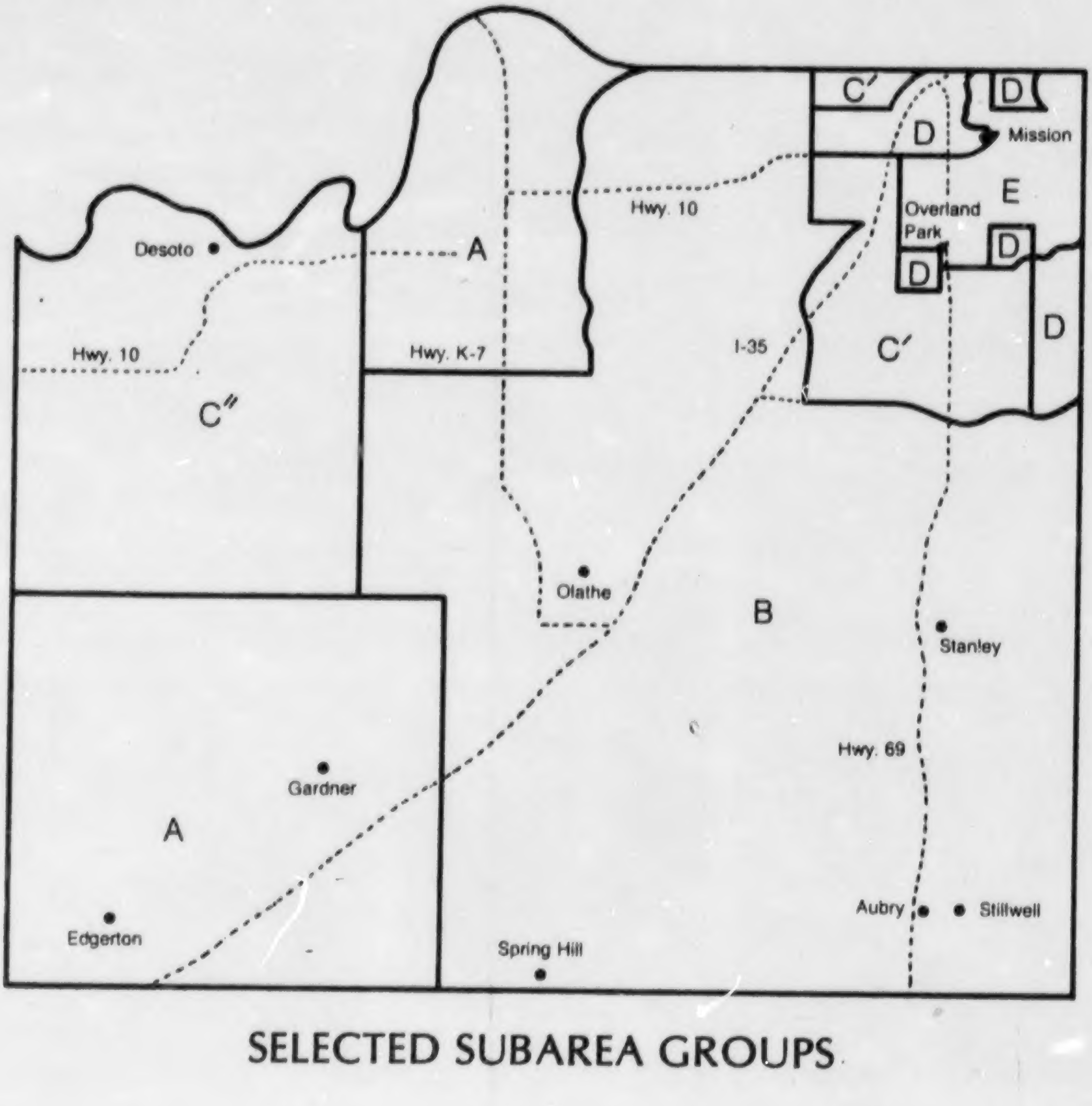
C. Maximum rate of development. During this stage in-migration greatly exceeds out-migration.

D. Reduced rate of growth. As the area approaches maturity the rate of net in-migration begins to decline.

E. Maximum development. The available land is essentially fully utilized. During this stage, there is a gradual shift from in-migration to out-migration.

For Johnson County, population projections were made by age and sex for each of 33 subareas within Johnson County in addition to projections for the County as a whole. These 33 subareas were combined into the five groups described above on the basis of net migration for 1960-1970. The areas are illustrated on the following page. Due to inclusion of the Sunflower Ordinance Plant in Area C and other factors which have a cyclical or less well defined affect on its population characteristics, this area was subdivided into C' and C''. Further analysis of C'' is anticipated. The extent of development for these six areas is widely variant. For the County as a whole, the population in 1970 had grown to 10 to 20 percent of the County's ultimate capacity.

Selected demographic data pertaining to the Johnson County subareas are presented on pages 14-18.


C′
D
D
Mission
E
Overland Park
D
D
D
Hwy. 10
A
Desoto
Hwy. 10
Hwy. K-7
I-35
C′
C″
Olathe
B
Stanley
Hwy. 69
Gardner
A
Edgerton
Aubry
Stillwell
Spring Hill

SELECTED SUBAREA GROUPS

DEATH RATES
1973 JOHNSON COUNTY
(Deaths/1000 Population)

Geographic Area	Death Rate
A	6.6
B	5.2
C'	3.4
D	6.5
E	6.8
County	5.2

MEDIAN AGE
1970 JOHNSON COUNTY
(In Years)

Geographic Area	Age
A	24.5
B	24.4
C'	25.8
D	29.7
E	29.6
County	27.0

MEAN FAMILY INCOME
1969 JOHNSON COUNTY

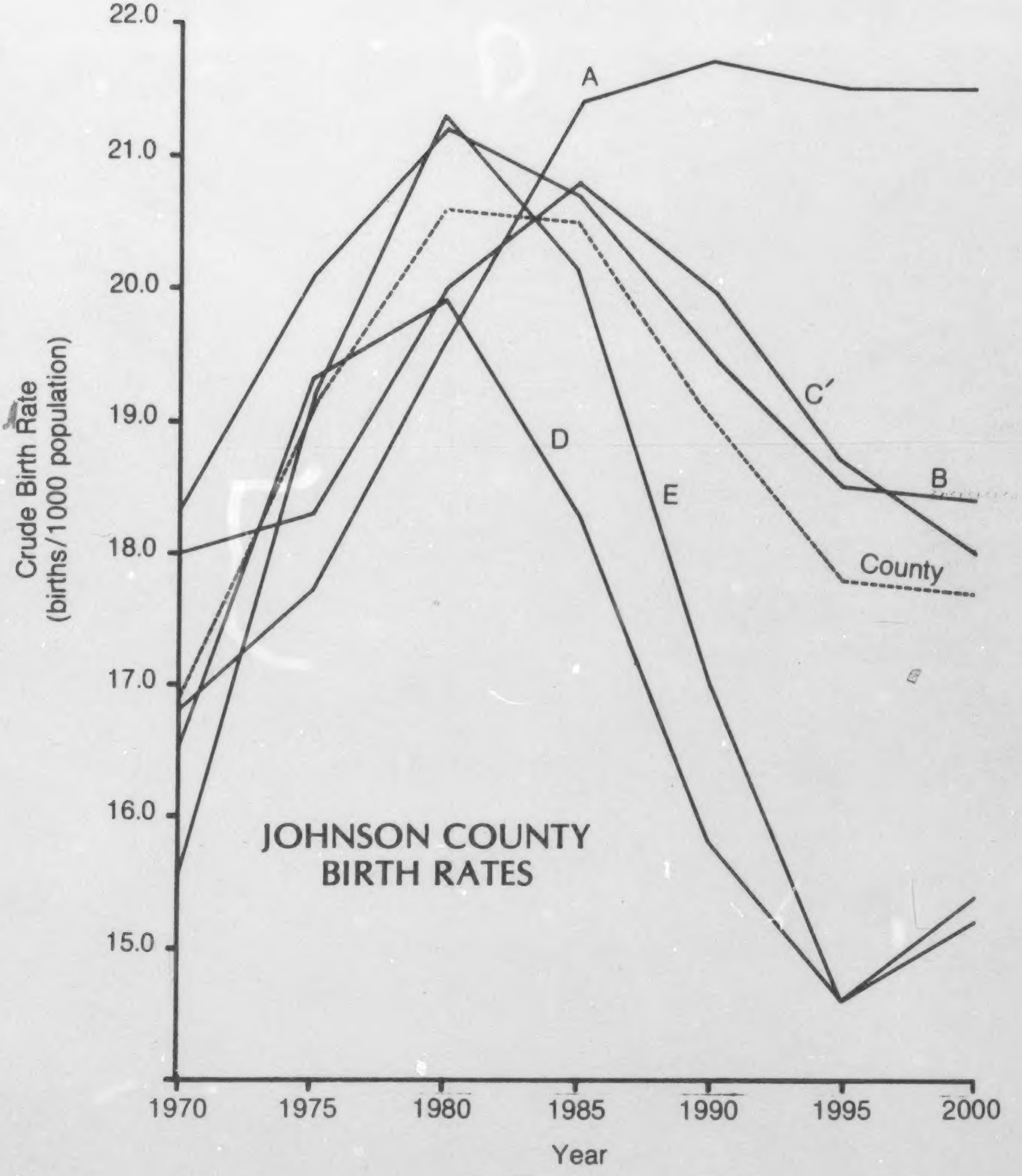
Geographic Area	Income
A	$10,107
B	11,932
C'	16,629
D	16,290
E	17,601
County	$15,762

WIDOWED OR DIVORCED POPULATION
1970 JOHNSON COUNTY
(Percent of Total Population)

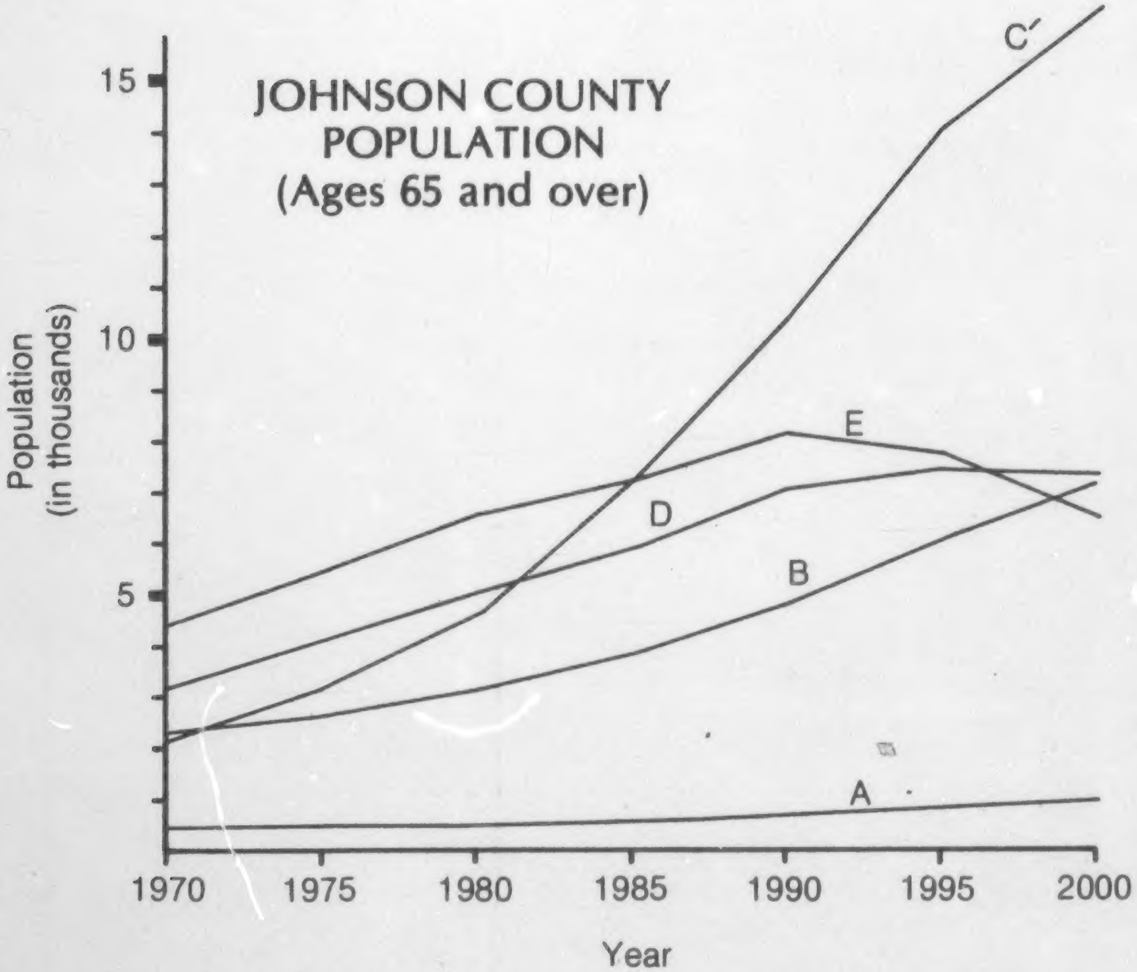
Geographic Area	Percentage
A	5.7
B	5.7
C'	3.5
D	6.2
E	5.7
County	5.1

NON-WHITE POPULATION
1970 JOHNSON COUNTY
(Percent of Total Population)

Geographic Area	Percentage
A	1.4
B	1.8
C'	0.8
D	0.5
E	0.5
County	0.8



JOHNSON COUNTY
BIRTH RATES
Crude Birth Rate
(births/1000 population)
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
1970
1975
1980
1985
1990
1995
2000
Year
A
B
C′
D
E
County


JOHNSON COUNTY
POPULATION
(Ages 65 and over)
Population
(in thousands)
15
10
5
1970
1975
1980
1985
1990
1995
2000
Year
C′
E
D
B
A

DATA FOR GEOGRAPHIC AREA C''

Median Age in Years, 1970	22.2
Mean Family Income, 1969	$9,902
Crude Death Rate, 1973 (Deaths per 1000 Population)	5.0
Non-white Population, 1970 (Percent of Total Population)	0.4%
Widowed or Divorced, 1970	5.7%
Crude Birth Rate (Births per 1000 Population)	
1970	17.3
1980	19.9
1990	19.4
2000	18.6
Population, Aged 65 and Over	
1970	293
1980	481
1990	876
2000	1684

Note: Sunflower is located within this geographic area. Further study in this rapidly changing area is anticipated in order to consider effects on population such as the level of employment at Sunflower.

APPENDIX G.

Answers to Selected Seminar Problems

Two-point - Linear Regression Problems

Subarea A

$$Y = \frac{8500 - 9000}{1970 - 1960}(x - 1960) + 9000$$

$$Y = -50(X - 1960) + 9000$$

Subarea B

$$Y = \frac{52500 - 28000}{1970 - 1960}(X - 1960) + 28000$$

$$Y = 2450(X - 1960) + 28000$$

Subarea C

$$Y = \frac{107{,}000 - 28300}{1970 - 1960}(X - 1960) + 28300$$

$$Y = 7870(X - 1960) + 28300$$

Subarea D

$$Y = \frac{58000 - 42400}{1970 - 1960}(X - 1960) + 42400$$

$$Y = 1560(X - 1960) + 42400$$

Subarea E

$$Y = \frac{74000 - 72300}{1970 - 1960}(X - 1960) + 72300$$

$$Y = 170(X - 1960) + 72300$$

For each subarea, X denotes year

Y denotes population for year x

Linear Regression Problem (Multiple-Point)

$Y = bX + a$

where Y is freshman Pirate County Community College enrollment

X is year

Given freshman enrollment for 1970-73,

$n = 4$, $\Sigma X = 1970 + 1971 + 1972 + 1973 = 7886$

$\Sigma Y = 1500 + 2000 + 2500 + 3000 = 9000$

$\Sigma X^2 = (1970)^2 + (1971)^2 + (1972)^2 + (1973)^2$
$= 15,547,254$

$\Sigma XY = (1970)(1500) + (1971)(2000) + (1972)(2500)$
$+ (1973)(3000) = 17,746,000$

$$b = \frac{4(17,746,000) - (7886)(9000)}{4(15,547,254) - (7886)^2} = \frac{10000}{20} = 500$$

$$a = \frac{9000}{4} - 500\left(\frac{7886}{4}\right) = -983,500$$

$Y = 500X - 983,500$

In 1982, projected freshman enrollment would be 7500.

$Y = bX + a$

where Y is sophomore Pirate County Community College enrollment

X is year

Given sophomore enrollment for 1970-73,

$n = 4, \quad \Sigma X = 1970 + 1971 + 1972 + 1973 = 7886$

$$\Sigma X^2 = (1970)^2 + (1971)^2 + (1972)^2 + (1973)^2 = 15{,}547{,}254$$

$$\Sigma Y = 1000 + 1200 + 1500 + 2000 = 5700$$

$$\Sigma XY = (1970)(1000) + (1971)(1200) + (1972)(1500) + (1973)(2000) = 11{,}239{,}200$$

$$b = \frac{4(11{,}239{,}200) - (7886)(5700)}{4(15{,}547{,}254) - (7886)^2} = \frac{6600}{20} = 330$$

$$a = \frac{5700}{4} - 330\left(\frac{7886}{4}\right) = -649{,}170$$

$$Y = 330X - 649{,}170$$

In 1982, projected sophomore enrollment would be 4,890

Logistic Problem Answers

Subarea A Assume capacity is 359,000

$t_1 = 1960$ $P_{1960} = 9000$

$t_2 = 1970$ $P_{1970} = 8500$

$$a = \ln\left(\frac{359000 - 9000}{9000}\right) = 3.660709$$

$$b = \frac{\ln\left(\frac{359000 - 8500}{8500}\right) - 3.660709}{1970 - 1960} = .005859$$

$$P_{1960+\theta} = \frac{359000}{1 + e^{3.660709 + .005859\theta}}$$

Subarea B Assume capacity is 746,000

$t_1 = 1960$ $P_{1960} = 28000$

$t_2 = 1970$ $P_{1970} = 52500$

$$a = \ln\left(\frac{746000 - 28000}{28000}\right) = 3.244265$$

$$b = \frac{\ln\left(\frac{746000 - 52500}{52500}\right) - 3.244265}{1970 - 1960} = -.066333$$

$$P_{1960+\theta} = \frac{746000}{1 + e^{3.244265 - .066333\theta}}$$

Subarea C Assume capacity is 243,000

$t_1 = 1960$ $P_{1960} = 28300$

$t_2 = 1970$ $P_{1970} = 107000$

$$a = \ln\left(\frac{243000 - 28300}{28300}\right) = 2.026380$$

$$b = \frac{\ln\left(\frac{243000 - 107000}{107000}\right) - 2.026380}{1970 - 1960} = -.178655$$

$$P_{1960+\theta} = \frac{243000}{1 + e^{2.026380 - .178655\theta}}$$

Subarea D Assume capacity is 75,000

$t_1 = 1960$ $P_{1960} = 42,400$

$t_2 = 1970$ $P_{1970} = 58,000$

$$a = \ln\left(\frac{75000 - 42400}{42400}\right) = -.262836$$

$$b = \frac{\ln\left(\frac{75000 - 58000}{58000}\right) + .262836}{1970 - 1960} = -.096439$$

$$P_{1960+\theta} = \frac{75000}{1 + e^{-.262836 - .096439\theta}}$$

Subarea E Assume capacity is 83,000

$t_1 = 1960$ $P_{1960} = 72,300$

$t_2 = 1970$ $P_{1970} = 74,000$

$$a = \ln\left(\frac{83000 - 72300}{72300}\right) = -1.910580$$

$$b = \frac{\ln\left(\frac{83000 - 74000}{74000}\right) + 1.910580}{1970 - 1960} = -.019626$$

$$P_{1960+\theta} = \frac{83,000}{1 + e^{-1.910580 - .019626\theta}}$$

COHORT SURVIVAL PROBLEM

PIRATE COUNTY SCHOOL ENROLLMENT
Grade 5-12, 1970-73

Grade	1970	1971	1972	1973
5	4500	3500	3000	2900
6	5200	4500	3500	3000
7	5400	5300	4500	3600
8	5100	5400	5300	4600
9	5900	5200	5300	5200
10	6000	5900	5500	5200
11	5500	5400	5200	5300
12	4800	5000	5200	5000

PIRATE COUNTY COMMUNITY COLLEGE ENROLLMENT
1970-73

Grade	1970	1971	1972	1973
College Freshman	1500	2000	2500	3000
College Sophomore	1000	1200	1500	2000

SURVIVAL RATES

Grade	1970-71	1971-72	1972-73	Average	Alternate Case
5-6	1,0000	1.0000	1.0000	1.0000	1.1000
6-7	1.0192	1.0000	1.0286	1.0159	1.0159
7-8	1.0000	1.0000	1.0222	1.0074	1.0074
8-9	1,0196	,9815	,9811	,9941	.9941
9-10	1.0000	1,0577	,9811	1.0129	1.0129
10-11	,9000	,8814	,9636	,9150	.9150
11-12	.9091	,9630	,9615	,9445	.9445
12-College Freshman	.4167	,5000	.5769	,4979	.4979
College Freshman-Sophomore	.8000	,7500	.8000	,7833	.8300

PROJECTED ENROLLMENTS USING AVERAGE SURVIVAL RATES
1974-1982

Grade	1974	1975	1976	1977	1978	1979	1980	1981	1982
6	2900	*	*	*	*	*	*	*	*
7	3048	2946	*	*	*	*	*	*	*
8	3627	3071	2968	*	*	*	*	*	*
9	4573	3606	3053	2950	*	*	*	*	*
10	5267	4632	3653	3092	2988	*	*	*	*
11	4758	4819	4238	3342	2829	2734	*	*	*
12	5006	4494	4552	4003	3157	2672	2582	*	*
College Freshman	2490	2492	2238	2266	1993	1572	1330	1286	*
College Sophomore	2350	1950	1952	1753	1725	1561	1231	1042	1007

*Cannot be obtained from data provided.

PROJECTED ENROLLMENTS USING SAMPLE CASE SURVIVAL RATES
1974-1982

Grade	1974	1975	1976	1977	1978	1979	1980	1981	1982
6	3190	*	*	*	*	*	*	*	*
7	3048	3241	*	*	*	*	*	*	*
8	3627	3071	3265	*	*	*	*	*	*
9	4573	3606	3053	3246	*	*	*	*	*
10	5267	4632	3653	3092	3288	*	*	*	*
11	4758	4819	4238	3342	2829	3009	*	*	*
12	5006	4494	4552	4003	3157	2672	2842	*	*
College Freshman	2490	2492	2238	2266	1993	1572	1330	1415	*
College Sophomore	2490	2067	2068	1858	1881	1654	1305	1104	1174

*Cannot be obtained from data provided.

BIRTH DATA BY AGE OF MOTHER FOR 1960 AND 1970
PIRATE COUNTY

Age of Mother	1960		1970	
	Births	Fertility Rates*	Births	Fertility Rates*
10-14	2	.221	5	.293
15-19	183	36.769	497	36.573
20-24	516	152.212	1634	152.311
25-29	909	161.858	1961	162.079
30-34	548	69.159	726	68.972
35-39	198	22.929	232	23.112
40-44	49	6.889	76	7.077
45-49	1	.172	3	.293
Total	4320		5134	

* Per 1000 women of that age group.

CRUDE BIRTH AND DEATH RATES AND FERTILITY RATES
FOR WOMEN AGES 15-44 FOR 1970

Subarea	Births	Crude Birth Rate	Deaths	Death Rate	Women Ages 15-44	Fertility Rate*
A	143	16.82	52	6.12	1769	80.84
B	960	18.28	273	5.20	11996	80.03
C	1927	18.01	361	3.37	26057	73.95
D	954	16.45	356	6.14	12583	75.82
E	1150	15.54	451	6.09	15314	75.09
County	5134	17.11	1493	4.98	67719	75.81

* Per 1,000 women, ages 15-44.

MIGRATION FOR DECADE 1960-1970
PIRATE COUNTY

Subarea	Births 1960	Births 1970	Average Births Per Year	Deaths 1960	Deaths 1970	Average Deaths Per Year	Population 1960	Population 1970	Births For Decade	Deaths For Decade	Net Migration For Decade
A	242	143	192.5	62	52	57	9000	8500	1925	570	-1855
B	817	960	888.5	225	273	249	28000	52500	8885	2490	18105
C	836	1927	1381.5	81	361	221	28300	107000	13815	2210	67095
D	938	954	946	277	356	316.5	42400	58000	9460	3165	9305
E	1487	1150	1318.5	327	451	389	72300	74000	13185	3890	-7595
County	4320	5134	4727	972	1493	1232.5	180000	300000	47270	12325	85055

SUBAREA PERCENTAGE SHARE OF PIRATE COUNTY MIGRATION
1960-1970

Subarea	Percentage of County Migration for Decade
A	-2.18%
B	21.29
C	78.88
D	10.94
E	- 8.93

POPULATION AND DEATH DATA FOR PIRATE COUNTY
1960

Age Group	Males Population	Males Deaths	Males Death Rate*	Females Population	Females Deaths	Females Death Rate*
Under 1	1966	45	22.89	1850	33	17.84
1-4	8949	5	.56	9275	5	.54
5-9	12505	7	.56	12413	5	.40
10-14	10737	5	.47	9042	3	.33
15-19	5443	3	.55	4977	1	.20
20-24	3057	3	.98	3390	1	.29
25-29	4403	0	.00	5616	1	.18
30-34	6909	5	.72	7924	5	.63
35-39	8824	9	1.02	8636	7	.81
40-44	6997	23	3.29	7112	19	2.67
45-49	5676	21	3.70	5794	14	2.42
50-54	4528	47	10.38	4090	25	6.11
55-59	2907	36	12.38	2840	20	7.04
60-64	2091	47	22.48	2594	31	11.95
65-69	1666	49	29.41	1939	34	17.53
70-74	1051	70	66.60	1628	60	36.86
75-79	694	61	87.90	1042	56	53.74
80-84	309	46	148.87	602	60	99.67
85 +	188	44	234.04	336	66	196.43
Total	88,900	526	5.92	91,100	446	4.90

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA A
1960

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	130	3	23.08	131	2	15.27
1-4	483	0	.00	489	0	.00
5-9	472	1	2.12	420	0	.00
10-14	376	0	.00	370	0	.00
15-19	765	1	1.31	342	0	.00
20-24	699	1	1.43	305	0	.00
25-29	405	0	.00	304	0	.00
30-34	419	0	.00	299	0	.00
35-39	325	1	3.08	236	0	.00
40-44	249	1	4.02	187	1	5.35
45-49	147	1	6.80	136	0	.00
50-54	137	1	7.30	124	1	8.06
55-59	109	1	9.17	103	1	9.71
60-64	88	2	22.73	94	1	10.64
65-69	108	3	27.78	110	2	18.18
70-74	71	4	56.34	98	3	30.61
75-79	59	6	101.69	73	5	68.49
80-84	36	5	138.89	49	5	102.04
85 +	21	4	190.48	30	6	200.00
Total	5,100	35	6.86	3,900	27	6.92

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA B
1960

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	407	9	22.11	425	8	18.82
1-4	1519	1	.66	1602	1	.62
5-9	1756	1	.57	1551	1	.64
10-14	1402	1	.71	1373	0	.00
15-19	947	0	.00	1058	0	.00
20-24	862	1	1.16	952	0	.00
25-29	975	0	.00	1064	1	.94
30-34	1011	1	.99	1053	1	.95
35-39	1002	1	1.00	913	1	1.10
40-44	763	2	2.62	730	2	2.74
45-49	643	2	3.11	657	2	3.04
50-54	600	7	11.67	597	3	5.03
55-59	452	6	13.27	494	3	6.07
60-64	373	9	24.13	444	6	13.51
65-69	361	11	30.47	430	8	18.60
70-74	234	15	64.10	380	14	36.84
75-79	200	17	85.00	277	15	54.15
80-84	123	19	154.47	190	19	100.00
85 +	70	16	228.57	110	21	190.91
Total	13,700	119	8.69	14,300	106	7.41

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA C
1960

Age Group	Males			Females		
	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	412	10	24.27	372	7	18.82
1-4	1953	1	.51	1922	1	.52
5-9	2287	1	.44	2253	1	.44
10-14	1641	1	.61	1486	1	.67
15-19	506	0	.00	599	0	.00
20-24	221	0	.00	523	0	.00
25-29	901	0	.00	1192	0	.00
30-34	1605	1	.62	1823	1	.55
35-39	1916	2	1.04	1662	1	.60
40-44	1045	3	2.87	824	2	2.43
45-49	594	3	5.05	522	2	3.83
50-54	405	4	9.88	320	2	6.25
55-59	240	3	12.50	214	1	4.67
60-64	154	3	19.48	196	2	10.20
65-69	90	2	22.22	128	2	15.63
70-74	67	5	74.63	89	4	44.94
75-79	37	3	81.08	34	2	58.82
80-84	15	2	133.33	26	2	76.92
85 +	11	3	272.73	15	3	200.00
Total	14,100	47	3.33	14,200	34	2.39

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA D
1960

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	280	7	25.00	355	6	16.90
1-4	1847	1	.54	1789	1	.56
5-9	2508	1	.40	2573	1	.39
10-14	2243	1	.45	1847	1	.54
15-19	1245	1	.80	1278	1	.78
20-24	660	1	1.52	784	0	.00
25-29	1691	0	.00	1221	0	.00
30-34	1231	1	.81	1534	1	.65
35-39	1510	1	.66	1699	2	1.18
40-44	1584	6	3.79	1922	5	2.60
45-49	1600	5	3.13	1732	4	2.31
50-54	1518	15	9.88	1485	9	6.06
55-59	1147	14	12.21	1081	8	7.40
60-64	751	16	21.30	949	11	11.59
65-69	627	19	30.30	619	11	17.77
70-74	421	28	66.51	421	15	35.63
75-79	214	19	88.79	289	12	41.52
80-84	74	11	148.65	140	14	100.00
85 +	49	12	244.90	82	16	195.12
Total	20,600	159	7.72	21,800	118	5.41

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA E
1960

Age Group	Males			Females		
	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	737	16	21.71	567	10	17.64
1-4	3147	2	.64	3473	2	.58
5-9	5482	3	.55	5616	2	.36
10-14	5075	2	.39	3966	1	.25
15-19	1980	1	.51	1700	0	.00
20-24	615	0	.00	826	1	1.21
25-29	1031	0	.00	1835	0	.00
30-34	2643	2	.76	3215	2	.62
35-39	4071	4	.98	4126	3	.73
40-44	3356	11	3.28	3449	9	2.61
45-49	2692	10	3.71	2747	6	2.18
50-54	1868	20	10.71	1564	10	6.39
55-59	959	12	12.51	948	7	7.38
60-64	725	17	23.45	911	11	12.07
65-69	479	14	29.23	652	11	16.87
70-74	258	18	69.77	640	24	37.50
75-79	184	16	86.96	369	22	59.62
80-84	61	9	147.54	197	20	101.52
85 +	37	9	243.24	99	20	202.02
Total	35,400	166	4.69	36,900	161	4.36

* Per thousand persons.

POPULATION AND DEATH DATA FOR PIRATE COUNTY
1970

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	2634	48	18.22	2500	27	10,80
1-4	11026	6	.54	10410	5	.48
5-9	17245	10	,58	16414	4	,24
10-14	17386	4	,23	17041	5	,29
15-19	13838	26	1,88	13589	4	,29
20-24	8024	5	,62	10728	9	,84
25-29	10702	18	1,68	12099	5	,41
30-34	10075	10	,99	10526	5	,48
35-39	9539	11	1.15	10038	8	.80
40-44	10122	23	2,27	10739	21	1,96
45-49	10367	34	3.28	10228	29	2,84
50-54	7966	59	7.41	8070	43	5,33
55-59	6060	56	9.24	6155	35	5,69
60-64	4523	82	18.13	4791	53	11.06
65-69	2849	117	41,07	3349	59	17.62
70-74	1929	88	45,62	2739	79	28.84
75-79	1213	75	61.83	1831	89	48.61
80-84	569	54	94.90	1298	91	70.11
85 +	433	62	143.19	955	134	140,31
Total	146,500	788	5,38	153,500	705	4,59

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA A
1970

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	73	1	13.70	60	1	16.67
1-4	365	0	.00	355	0	.00
5-9	521	0	.00	448	0	.00
10-14	520	0	.00	490	0	.00
15-19	389	1	2.57	382	0	.00
20-24	368	0	.00	352	0	.00
25-29	294	1	3.40	307	0	.00
30-34	277	0	.00	266	0	.00
35-39	233	0	.00	225	0	.00
40-44	245	1	4.08	237	0	.00
45-49	236	1	4.24	240	1	4.17
50-54	183	1	5.46	189	1	5.29
55-59	168	2	11.90	136	1	7.35
60-64	123	2	16.26	138	1	7.25
65-69	114	5	43.86	118	2	16.95
70-74	77	4	51.95	96	3	31.25
75-79	62	4	64.52	73	4	54.79
80-84	29	3	103.45	51	4	78.43
85 +	23	3	130.43	37	5	135.14
Total	4,300	29	6.74	4,200	23	5.48

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA B
1970

Age Group	Males			Females		
	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	492	9	18.29	468	5	10.68
1-4	2129	1	.47	2061	1	.49
5-9	3179	2	.63	2848	1	.35
10-14	3054	1	.33	3051	1	.33
15-19	2616	5	1.91	2649	1	.38
20-24	1930	1	.52	2300	2	.87
25-29	2021	3	1.48	2097	1	.48
30-34	1902	2	1.05	1827	1	.55
35-39	1506	2	1.33	1508	1	.66
40-44	1599	4	2.50	1615	3	1.86
45-49	1450	5	3.45	1387	4	2.88
50-54	1115	8	7.17	1096	6	5.47
55-59	895	8	8.94	960	5	5.21
60-64	741	13	17.54	731	8	10.94
65-69	484	20	41.32	586	10	17.06
70-74	328	15	45.73	483	14	28.99
75-79	248	15	60.48	419	20	47.73
80-84	116	11	94.83	297	21	70.71
85 +	89	13	146.07	217	30	138.25
Total	25,900	138	5.33	26,600	135	5.08

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA C
1970

Age Group	Males Population	Deaths	Death Rate*	Females Population	Deaths	Death Rate*
Under 1	988	18	18.23	938	10	10.66
1-4	4145	2	,48	3903	2	,51
5-9	6890	4	,58	6518	1	,15
10-14	6724	1	,15	6638	2	,30
15-19	4846	9	1,86	4653	1	,21
20-24	2329	2	,86	3479	3	,86
25-29	4182	7	1.67	4932	2	,41
30-34	3937	4	1.02	4286	2	,47
35-39	4124	5	1,21	4203	3	,71
40-44	4373	9	2,06	4504	9	2,00
45-49	3719	12	3,23	3305	9	2.72
50-54	2854	21	7,36	2607	14	5,37
55-59	1542	14	9.08	1326	8	6.03
60-64	930	17	18,28	915	10	10,93
65-69	503	21	41.75	630	11	17.46
70-74	346	16	46.24	517	15	29.01
75-79	203	13	64.04	375	18	48.00
80-84	95	9	94.74	271	19	70.11
85 +	70	10	142.86	200	28	140,00
Total	52,800	194	3,67	54,200	167	3,08

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA D
1970

	Males			Females		
Age Group	Population	Deaths	Death Rate*	Population	Deaths	Death Rate*
Under 1	489	9	18.40	465	5	10.75
1-4	1775	1	.56	1671	1	.60
5-9	2747	2	.73	2670	1	.37
10-14	3092	1	.32	3017	1	.33
15-19	2707	5	1.85	2712	1	.37
20-24	1755	1	.57	2340	2	.85
25-29	1787	3	1.68	1980	1	.51
30-34	1683	2	1.19	1727	1	.58
35-39	1632	2	1.23	1850	2	1.08
40-44	1733	4	2.31	1974	4	2.03
45-49	2244	7	3.12	2376	7	2.95
50-54	1724	13	7.54	1872	10	5.34
55-59	1530	14	9.15	1602	9	5.62
60-64	1155	21	18.18	1304	15	11.50
65-69	782	32	40.92	369	15	17.26
70-74	527	24	45.54	703	20	28.25
75-79	294	18	61.22	434	21	48.39
80-84	137	13	94.89	303	21	69.31
85 +	107	15	140.19	226	32	141.59
Total	27,900	187	6.70	30,100	169	5.61

* Per thousand persons.

POPULATION AND DEATH DATA FOR SUBAREA E
1970

Age Group	Males Population	Males Deaths	Males Death Rate*	Females Population	Females Deaths	Females Death Rate*
Under 1	590	11	18.64	560	6	10.71
1-4	2614	2	.77	2429	1	.41
5-9	3908	2	.51	3930	1	.25
10-14	3996	1	.25	3845	1	.26
15-19	3280	6	1.83	3193	1	.31
20-24	1636	1	.61	2257	2	.89
25-29	2418	4	1.65	2783	1	.36
30-34	2276	2	.88	2420	1	.41
35-39	2044	2	.98	2252	2	.89
40-44	2172	5	2.30	2409	5	2.08
45-49	2718	9	3.31	2920	8	2.74
50-54	2090	16	7.66	2306	12	5.20
55-59	1925	18	9.35	2131	12	5.63
60-64	1574	29	18.42	1703	19	11.16
65-69	966	39	40.37	1146	21	18.32
70-74	651	29	44.55	935	27	28.88
75-79	406	25	61.58	530	26	49.06
80-84	192	18	93.75	376	26	69.15
85 +	144	21	145.83	275	39	141.82
Total	35,600	240	6.74	38,400	211	5.49

* Per thousand persons.

UNIVERSITY OF CALIF.
LOS ANGELES

MAR 11 1974

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